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Mechanical Drawing for Plumbers

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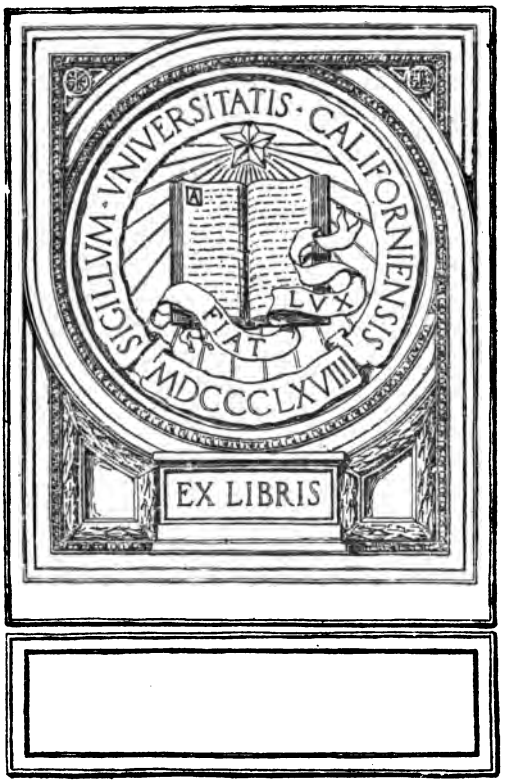

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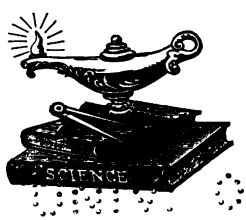
MECHANICAL DRAWING FOR PLUMBERS

A Concise, Comprehensive and Practical Treatise on the Subject of Mechanical Drawing, in Its Various Modern Applications to the Work of All Who Are in Any Way Connected With the Plumbing Trade.

BY

R. M. STARBUCK

Author of "Modern Plumbing Illustrated," "Standard Practical Plumbing," etc.



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INTRODUCTION.

The writing of this series of articles for THE PLUMBERS' TRADE JOURNAL has been undertaken with a firm conviction that a knowledge of the subject of plumbing drawing has to-day become a most valuable and practical acquisition to the working tools of the plumber. In fact, no person who is connected with construction work of any kind can afford to be without a thorough knowledge of such drawing as applies particularly to his line of work.

Much that the author has to say in this little treatise is the result of his own experience gained in the pursuit of the plumbing business, and it is the thought of the personal benefit that he has derived from a knowledge of this subject that has led him to attempt the writing of this series.

The writer believes that his readers will appreciate with him the many difficulties that confront an attempt to give instruction of this nature by means of printers' ink rather than by word of mouth, for certainly personal oral instruction is the only method to bring fullest results.

In conclusion, the author would say that it is his sincere hope that this little book may prove of some real and practical benefit to the younger men of our trade, for whom it is especially intended.

November, 1910. R. M. STARBUCK.

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Mechanical Drawing for Plumbers

CHAPTER I

THE man who to-day does high-class plumbing or heating, and is worthy the name of doing that class of work, is as deserving of credit as is the lawyer who conducts his case in court successfully, or the physician who performs the duties that devolve on him in creditable manner. The trade, we must remember, is not in the crude state that it was years ago, and if the plumber keeps abreast of the times, he must educate himself along several lines in addition to the manual side of the question. He must be conversant to some extent with chemistry, and the subject of physics, that is, natural law, is more valuable to him than to any other man that we can think of. If he is to make the most of himself and his opportunities, the progressive man cannot do better than to take up the study of mechanical drawing, at least so far as it concerns the laying out of plumbing and heating work. A knowledge of the subject is valuable, not only to the man who is conducting a business and uses his knowledge in demonstrating his ideas to the prospective customer, but even the apprentice cannot afford to be ignorant of it, for on paper he can lay out work, run his lines of pipe and make his connections—all in a practical way—and gain experience thereby that he cannot gain in serving at the trade unless more fortunate than his brothers in the advantages that are given him.

The writer has in mind instances where the obtaining of good work can be traced directly to the fact that a neat little sketch of the proposed work was submitted to the owner. The sketch showed that the one who presented it was up-to-date, and knew his business, and that thereby he gained a better place in the opinion of his customer than his competitor, was to be expected.

And it is these little points that count, not merely to-day, but always in the years to come.

In many sections of the country, particularly where the work is of a high grade, the master and the journeyman must as a part of the examination make a drawing of some system of plumbing. Another quite general custom nowadays is the demand by boards of health, that the plumber applying for a permit to do work, shall first submit drawings of the proposed work.

How convenient, and even profitable, to be able to submit work on such occasions as we have just cited, which shall be creditable. In visiting the different sections of the country; it has been impressed upon the writer's mind that there is a great demand for a knowledge of this subject, a demand which has not yet been met.

The correspondence school fills a long-felt want, and we believe it to be a valuable institution, but ofttimes a busy man does not feel that he can spare the time necessary to such a course as given by them, which necessitates the taking up of

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several branches of study as a means of covering the whole ground. While we would not dignify our present series of articles as a "course in drawing," it is our intention to make it serve as such, as near as possible.

It will be appreciated that the subject is a difficult one to present, as it is best studied under an instructor who can correct an error on the spot, and explain fully wherein the error lies.

We would say, that in pursuing this series, it is with the idea of making it of real practical value to those of our readers who are interested in the subject, as we believe that every master plumber and steam fitter should thoroughly understand the manner to draw at least in a crude way the plans for work on which he may estimate.

As a preliminary to pursuing the subject of drawing, the student should provide himself with the necessary tools, which include the drawing board, tee square and triangles (30 deg. and 45 deg.) and a small set of instruments.

As to instruments, unless it is desired to take up the inking of drawings, the only instruments actually needed are a pair of compasses for making large circles, and a pair of bow compasses for small circles. The latter instrument is of special value in making neat work.

In Fig. 1 we show the drawing board, with the tee square in position, also both triangles. In Fig. 2 the large compasses are shown, and in Fig. 3 the bow, or spring compasses.

The tee square and triangles may be of wood, for ordinary use. Celluloid triangles are especially good, as the work beneath shows through them.

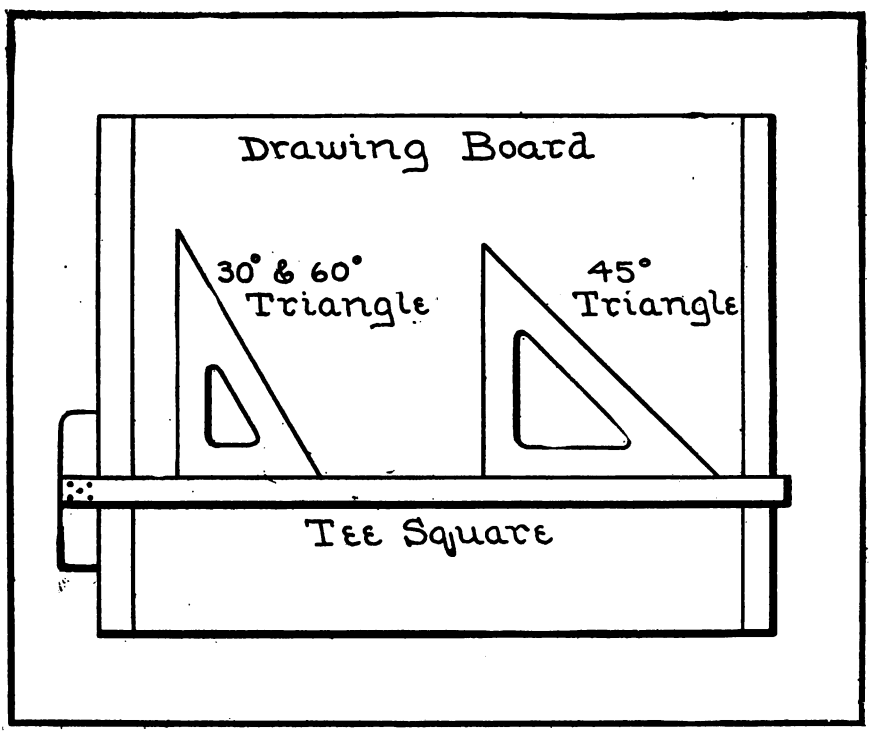

Figure 1

It is no doubt well known to our readers that horizontal lines are made along the edge of the tee square and vertical lines are made along the edge of the triangle held against the edge of the tee square. With triangles which are true, this insures true work, but if the vertical lines are made by holding the tee square against the lower edge of the board, there is very little chance of the work being

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true, that is square, for there is seldom a drawing board that will be found exactly square all round.

In entering upon the subject of mechanical drawing, whether it is such

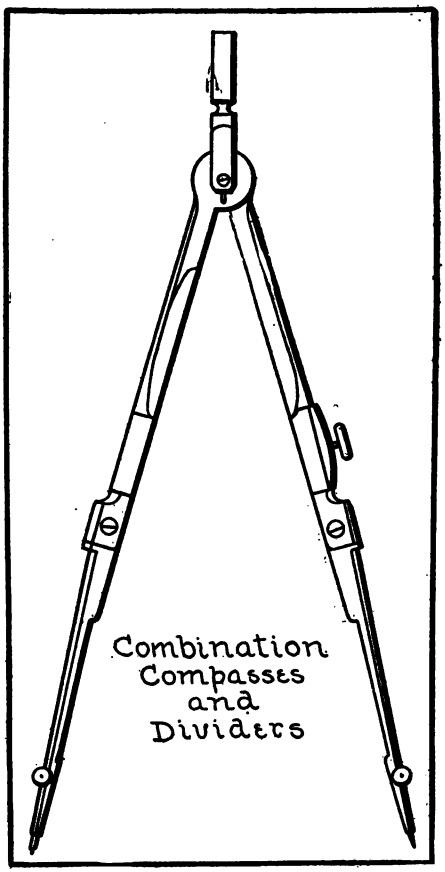

Fig. 2

drawing as the plumber, the machinist, or the architect would need, it is necessary to understand the principles of projection which in reality underlies the whole subject. All working drawings, which show several views of the same object, such as are used in every machine shop, are worked out by projection, and in this class of work it is applied much more extensively than on the work in which we are interested.

With us, it will not be necessary to take up any but the most elementary principles, for although valuable to any man, the more advanced principles of projection would not be of much practical worth to the plumber, as far as laying out his own work is concerned.

To show the fundamental principle of projection, let us consider the object which we show in Fig. 4, an ordinary pyramid.

Now suppose we consider this object surrounded by transparent surfaces, glass plates for instance, as shown in Fig. 5. We will suppose that the object is viewed from three different directions, from the front, from the side, and from the top. If we consider that the rays of light from each point, as these three views are taken, reach the eye at right angles to the respective glass plates, and draw on those plates the view of the object as it appears to us, we shall have what is known in mechanical drawing as

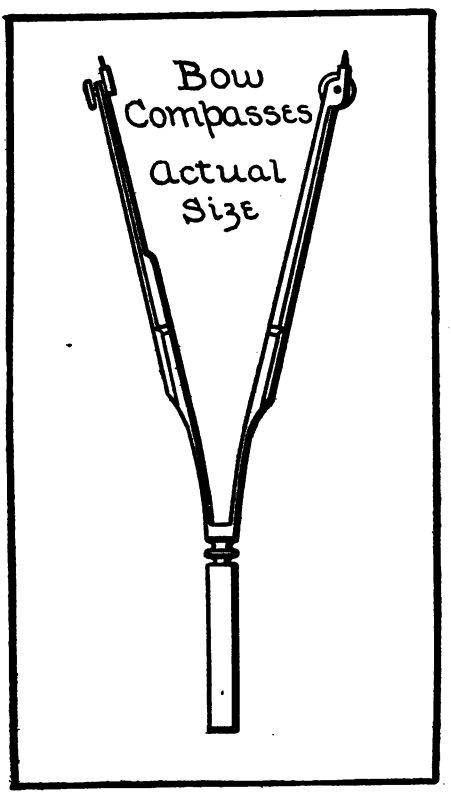

Fig. 3

the top view or plan, and the front and side views, or elevations, as they are commonly called. In other words, the eye is supposed to sight the object at right angles at every point at one time.

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Considering the views as obtained in this way, it will probably be clear to our readers that in mechanical drawing, the element of perspective is entirely absent.

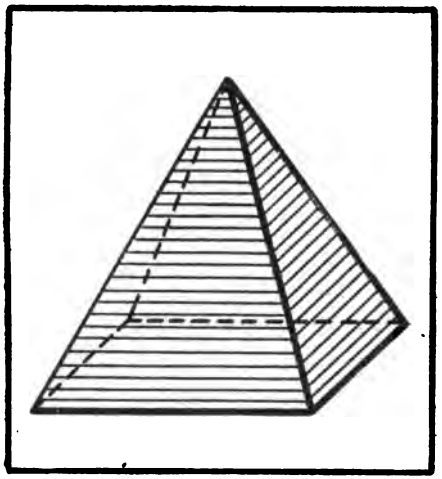

Fig. 4

This is a most important point, and should be firmly in the mind if a proper understanding of the subject is to be obtained.

To further impress this idea on the mind, we will consider a rectangular block such as we show in Fig. 6.

This view is what is known as a perspective view, and gives us the appearance of the object that we would ordinarily get by glancing at it. Now if the

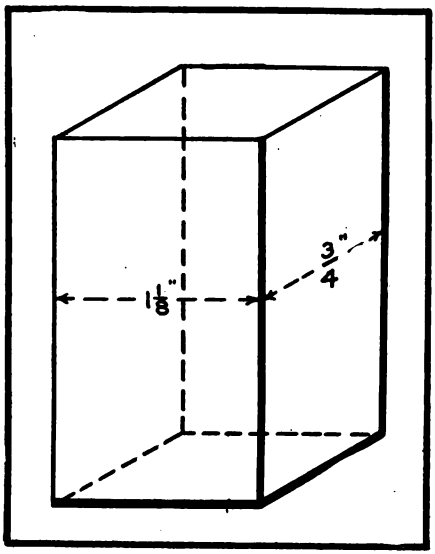

Fig. 6

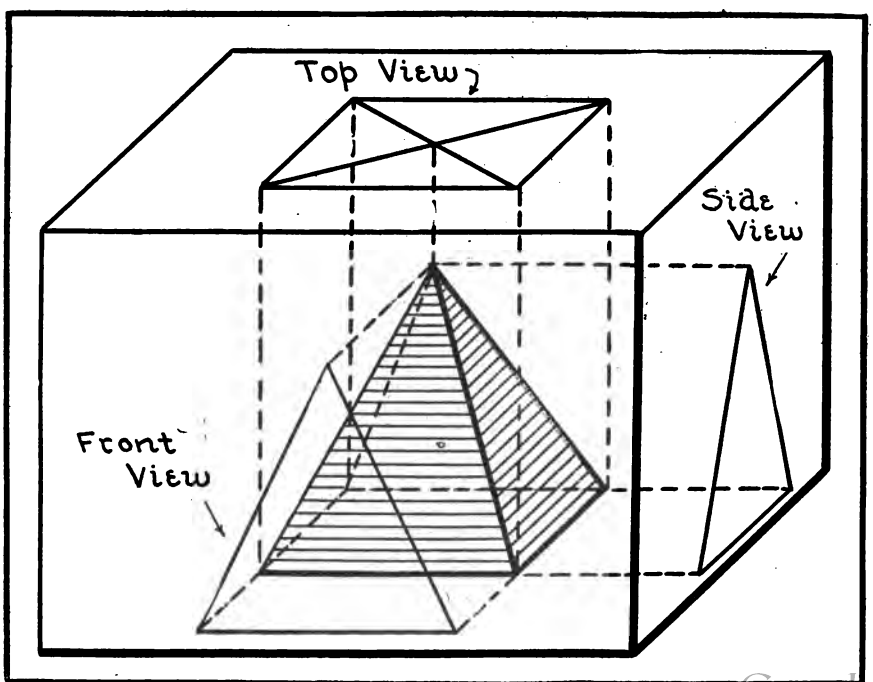

Fig. 5

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three views of this object are to be obtained, that is, the top, front and side

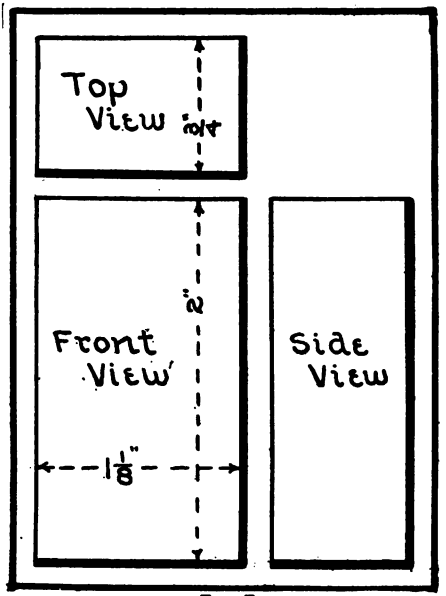

Fig. 7

views, after the manner in previous figures, they will be such as Fig. 7 shows. It will be readily seen that these three views give every dimension that would be required in making the given object from drawings, that is, height, width and thickness.

In fact, the front and top views without the side view give all that is required.

In mechanical drawing, when the object is complicated, it often happens that three views must be given to thoroughly depict the work, but in plumbing, usually only the top view, or plan, and one elevation is required.

At this point it is well to state that many of our readers will no doubt have difficulty in thoroughly understanding what we have written on projection. To these we would say that even though at the outset the subject is not clear, it will become plainer as the subject advances, and that it should not be an obstacle to going on, for we shall soon deal with the subject in a way that will appeal to the plumber from a practical and not from a technical standpoint, such as the opening of a matter of this kind must be.

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CHAPTER II

IN obtaining the views of an object, that is, the projections, as they are called in mechanical drawing, such as Fig. 7 shows in the preceding article, it is not necessary that the object be placed in any particular position when the views are taken. In ninety-nine cases out of a hundred, however, the object is supposed to be placed in the position from which the views can be most easily obtained, that is, directly facing the observer.

Suppose we consider, for instance, a short length of steel rod having six faces.

If the piece is placed so that it is squarely in front of the person making the drawing, with a face fully exposed, the front and top views would be such as Fig. 8 shows, but if placed in some odd position, such views as Fig. 9 shows will have to be made.

Either set of views shows the dimensions of the object equally well, but Fig. 8 is preferable, because simpler. It will be noticed that in which ever position the object is placed, the two views or more that are taken must be consistent. It would not do to combine the front view of Fig. 8 with the top view of Fig. 9.

With these explanations we shall leave the subject of projection as far as its technical points are concerned, though we may have to allude to it occasionally. In writing this series, we thoroughly appreciate the fact that very few of our readers in all probability, have ever taken up the

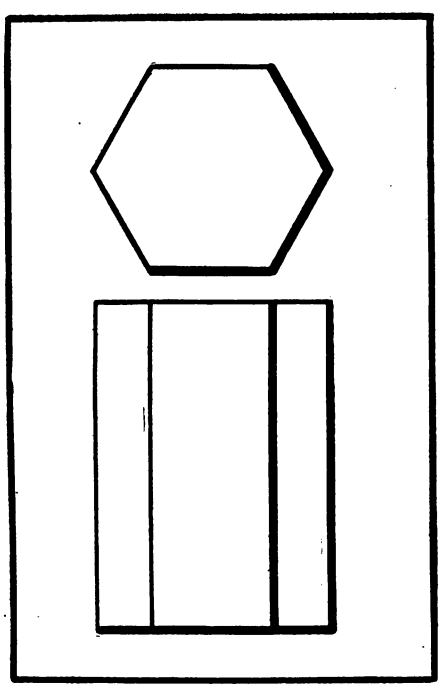

Fig. 8

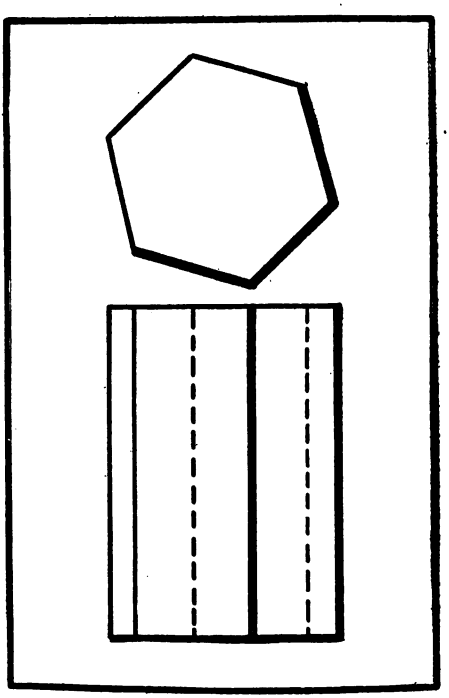

Fig. 9

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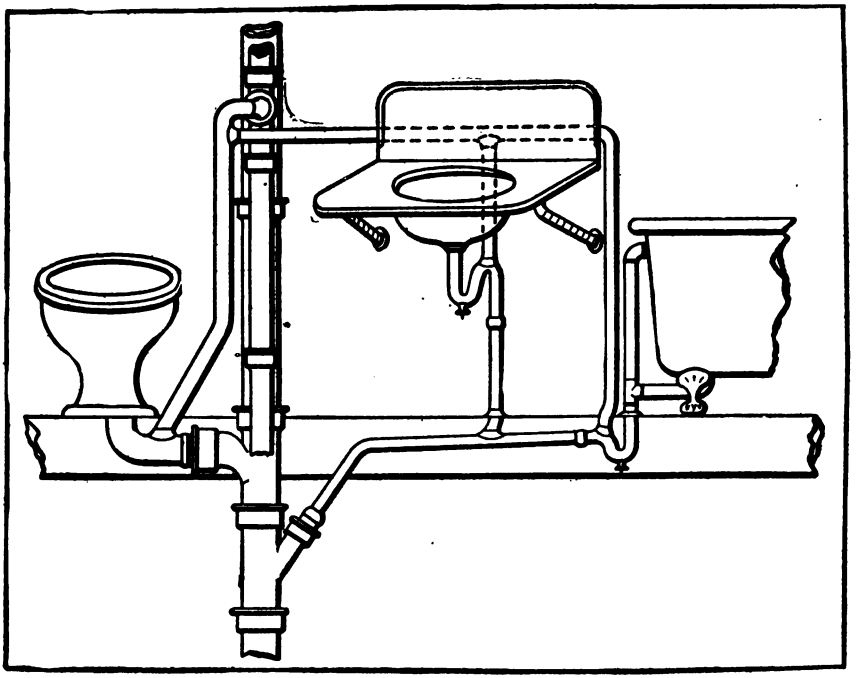

Fig. 10—A Combination of Perspective and Mechanical Drawing

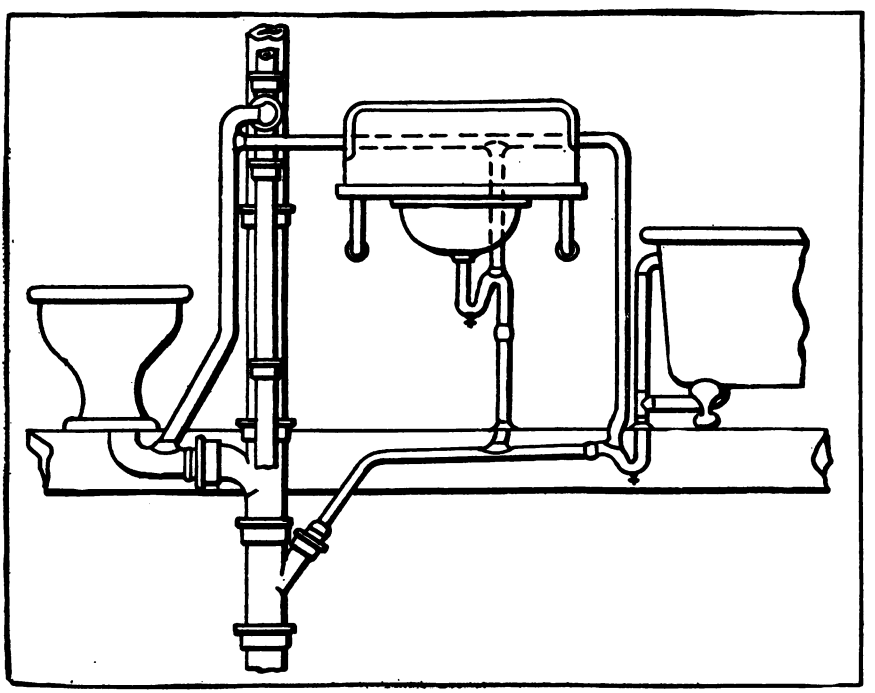

Fig. 11—An Illustration of Plain Mechanical Drawing

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subject of projection, that is, the making of working drawings, and we do not mean to scare our readers into the thought that they have got to grind away at that part of the work before being able to take up the real plumbing drawing.

It does not require any book knowledge to do the work either. A knowledge of plumbing, an eye to proportion, and some little skill are all that is required. The two latter qualifications naturally can be obtained only by practice, and to this end we would earnestly advise our readers to practice making drawings as we proceed with the subject, and after having made them, to compare the same with our sketches, and apply the criticisms, which we shall make from time to time.

In starting into the subject of plumbing drawing, we wish to emphasize a fact which we have already tried to make clear, and that is that perspective drawings should never be combined with mechanical drawing, for to those that have any knowledge of the subject, such work appears very inferior.

It is often seen, however, hardly a sketch made at examinations, indeed, that does not testify to the work. To thoroughly illustrate our meaning, we show in Fig. 10 a combination of perspective and mechanical drawing, and in Fig. 11 the same work in which nothing but mechanical drawing is to be found.

We give also in Fig. 12 a drawing which is entirely perspective.

Comparing Figs. 11 and 12, either one is correct, and shows the work in a proper manner. However, perspective,

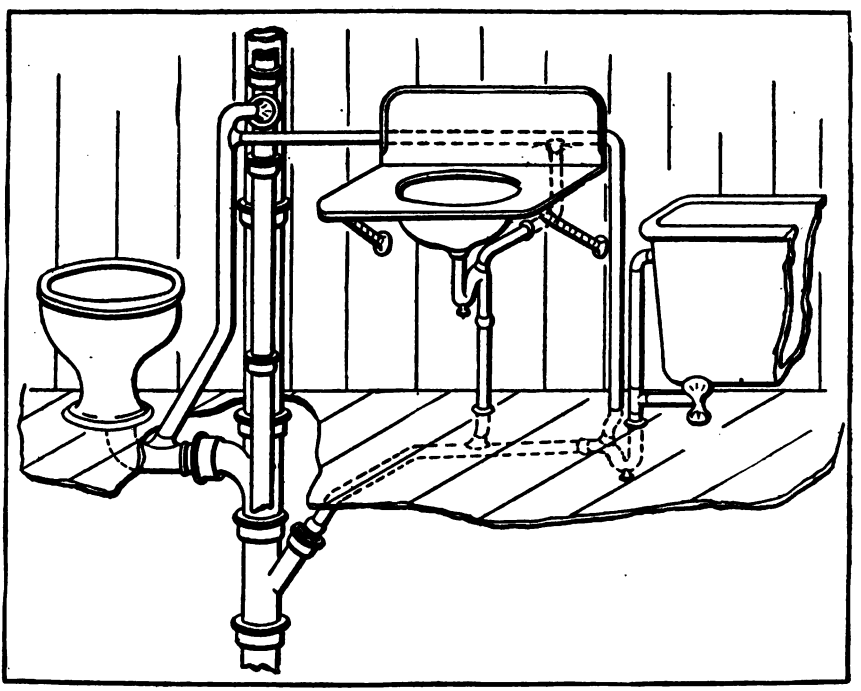

Figure 12—An Illustration of Perspective Drawing

such as shown in Fig. 12, is much more difficult drawing than the plain mechanical drawing of Fig. 11.

Therefore it would seem to the writer that as Fig. 11 illustrates a style of work which is entirely acceptable in showing all that is necessary to be known about the work, it should be chosen in preference to perspective drawing, and accordingly hereafter in this series we shall confine themselves almost entirely to the plain drawings.

We may add that it is not once in a

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hundred times that perspective drawing is required, though occasionally it is very valuable in showing work in its proper shape.

In Fig. 10, which illustrates the same piece of work as the other two sketches, we find the two classes of drawing combined, and the effect is poor.

It will be noticed that while a plain, mechanical view is given of the tub, the lavatory is shown entirely in perspective, and the water closet partly so.

The latter shows especially poor taste. A glance at the water closet will show that while the main part of the bowl is shown plain, the circular rim is shown in its perspective appearance instead of the manner shown in Fig. 11. If the upper part of the bowl is in perspective, the whole drawing should be, as shown in Fig. 12.

This error is met with time and time again. As we have stated while considering the subject of projection, in mechanical drawing a view may be taken looking directly down onto the object, and another view may be taken by looking directly at the front of it, but in this branch of drawing, the two views must never be run together, as they must have been to give the view of the water closet shown in Fig. 10. Another point to be observed in connection with the work shown in Fig. 10 is that, if the drawing is designed to show the work in perspective, to be consistent, the piping should be shown in perspective just as much as the lavatory is, and after the style in which the piping in Fig. 12 is drawn.

A fixture should never be drawn in perspective without making all the work connected with it to agree.

For instance, the trap, waste, and back air for the lavatory are shown plain, which is inconsistent with the appearance of the fixture itself. The back air pipe running straight up from the crown of the pipe looks as if it must break through the bowl and marble slab, while the lines which are dotted show that this pipe in reality runs behind the marble back.

It should be noted that when lines of pipe or, in fact, any part of the work is hidden behind anything it is customary to dot the lines instead of making them full. Thus in Fig. 12 the pipe that runs under the floor is shown dotted.

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CHAPTER III

AS we proceed with this series it is the intention of the writer to give exercises in drawing, simple at first, and growing more difficult as the subject advances. Those who are following the series with the idea of using the instruction given as a means of learning how to make plumbing drawings, should lay out the work given, endeavoring to make it as nearly like the model which we show as possible. We shall very often as in Figs. 13, 14 and 15, give correct illustrations of work, and one or more additional incorrect sketches showing errors that are often made. Now as to laying out the work in Fig. 13, simply remember that the horizontal lines are to be made with the tee square as shown in Chapter I, and the vertical lines by using the triangle against the tee square. We would say that in working out these

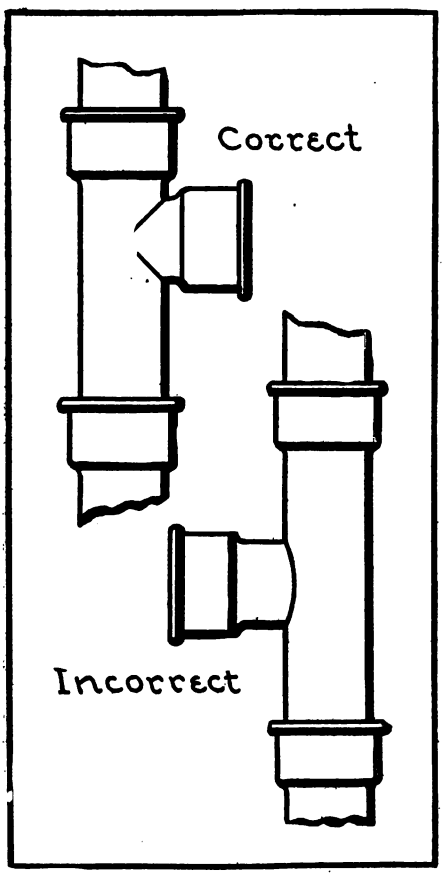

Fig. 13—Horizontal Lines to be made with T square

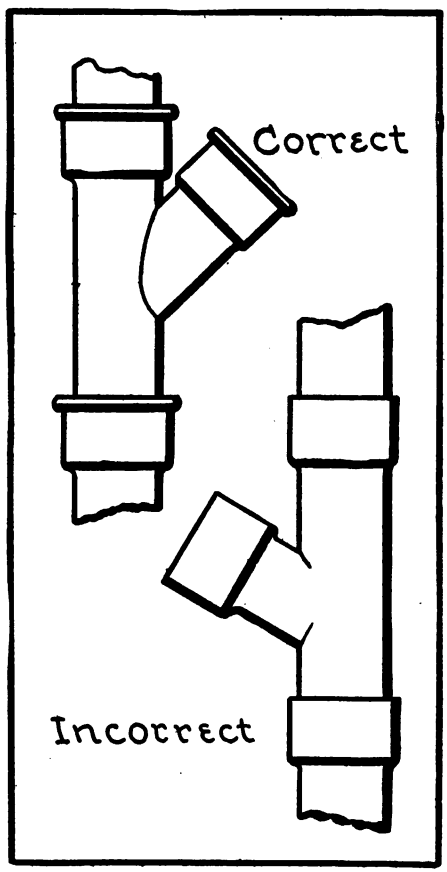

Fig. 14—Showing Correct and Incorrect Sketch

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exercises they should be done in pencil, and not inked, as that will be taken up later on. Since no inking is to be done, all lines should be made plain and not shaded with heavy lines as our sketches are made.

The shading is done to give character to an illustration and to set it out, and the method of doing it will be taken up under the subject of inking. In laying out the tee in Fig. 13, be careful to proportion the branch properly. Do not get it into the center of the fitting as the incorrect sketch shows, and do not have the branch too long, as is also shown. Another point, a small one however, is the

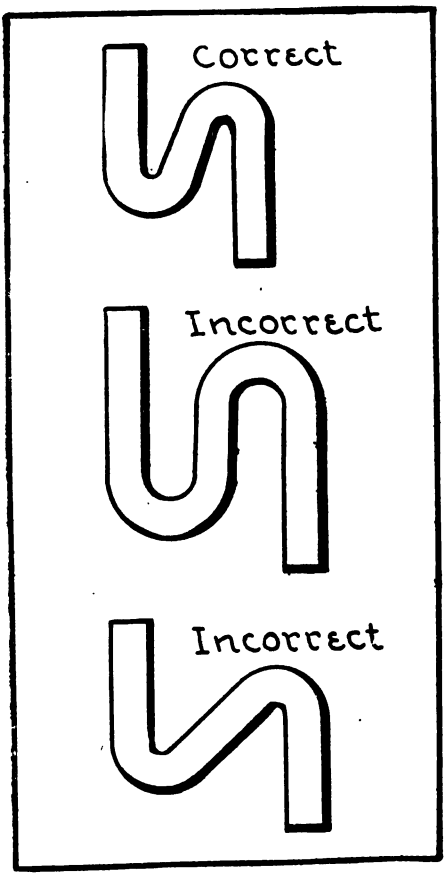

Fig. 15 —Another Example of Correct and Incorrect Work

intersection of the branch with the main part of the fitting. Do not make it in the form of a curve as the incorrect sketch shows, but with two 45 degree lines.

In laying out the Y, Fig. 14, notice that the branch is at 45 degrees with the length of the fitting, and consequently should be laid out with the 45 degree

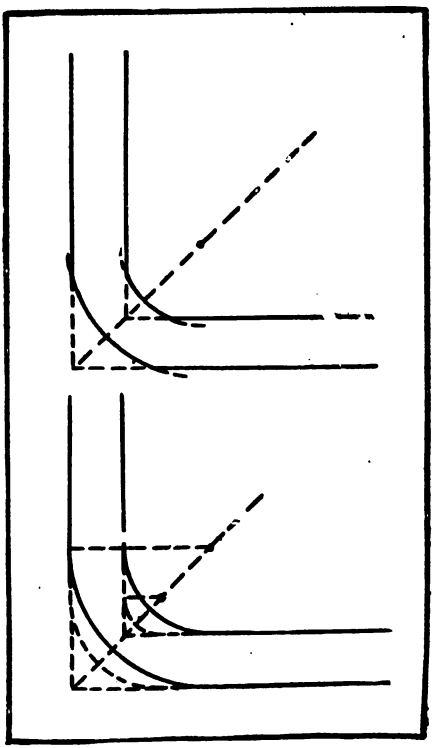

Fig. 10 —Curve in Lower Sketch Not Properly Drawn

triangle placed against the tee square.

Do not place the branch far down on the fitting as the incorrect sketch shows.

The hubs shown on the latter sketch do not give as good an appearance to the work as those in which a bead is shown at the top. Although the intersection of the branch and fitting is a curve, as shown, the method in the incorrect sketch answers as well, and is much easier. In drawing the S trap, Fig. 15, draw in the straight parts of the trap first, and put in the curves next. Do not get the three branches of the trap too far apart, as shown in the incorrect sketches, and the middle part should the center to either of the lines, the curve neither be quite vertical, nor on too much of a slant. Speaking of the curves reminds us that a little instruction is needed on the proper manner of putting

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them in. If two lines at right angles to each other are to be joined by a curve, it is necessary to take the center for the curve at an equal distance from each

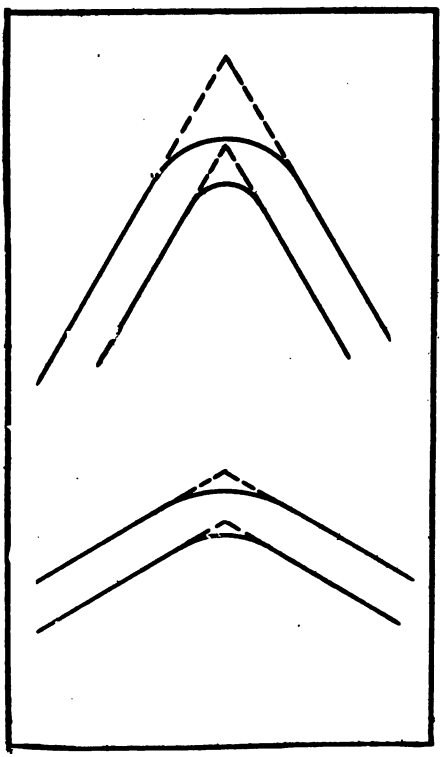

Fig. 17—Showing How Curves are Put In, Joining Lines at Odd Angles

line, and from this point, with a distance on the compasses equal to that from will join both lines as the upper sketch in Fig. 16 shows.

A very common error in those just beginning the subject is to draw the curve as it appears in the lower sketch of Fig. 16, that is, so that it does not run smoothly into the straight lines, but leaves a corner at the point where the curve joins. Even though the center is taken so that it is equally distant from each line, this fault may occur by taking too long a radius on the compasses, a distance greater than the perpendicular distance from the center of the line.

The exact point for taking this center is on the 45-degree line from the angle made by the two lines, the dotted line in the sketch as illustrated on page 17.

With the center taken at any point on this line, the two straight lines can be joined with a smooth curve, the curve being longer or shorter as the center is taken further from or nearer to the angle.

We are often required to put in curves joining lines which are at some odd angle as in Fig. 17. In this case it is more difficult to find a line of centers, and it is usual to keep trying one point after another until the right point for the center is found. In fact, draughtsmen seldom take the trouble to find a line for their center as Fig. 16 shows, but soon become so expert in finding by trial the right location from which to strike the curve, that they seldom need more than a couple attempts before obtaining the right point.

We have stated that our intention is to

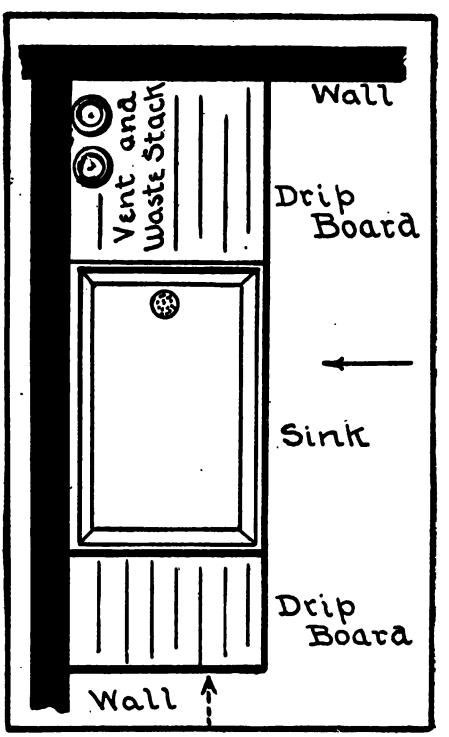

Fig. 18—Sketch Obtained by Looking Down Into the Sink

give exercises for practice work. In addition to that we shall carry along the general subject of plumbing drawing as well.

There are two views which are neces-

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sary to show any piece of plumbing work in full.

One is the plan, the other the elevation.

As most of our readers have had experience in working from architects' plans, they know that it is customary to give only a cellar plan of the plumbing, and the several floor plans showing the location of fixtures and soil, waste and vent lines, leaving the plumber to put in his connections according to his own ideas.

However, on many of the best jobs nowadays, architects are giving an elevation, showing the manner in which the work is to be laid out.

If the architect is practical in his ideas on plumbing construction, this should often be of help to the plumber, especially from the fact that it should have a tendency to make competitors figure more nearly on the same basis. We show in Fig. 18 a plan, and in Fig. 19 an elevation of the common kitchen sink.

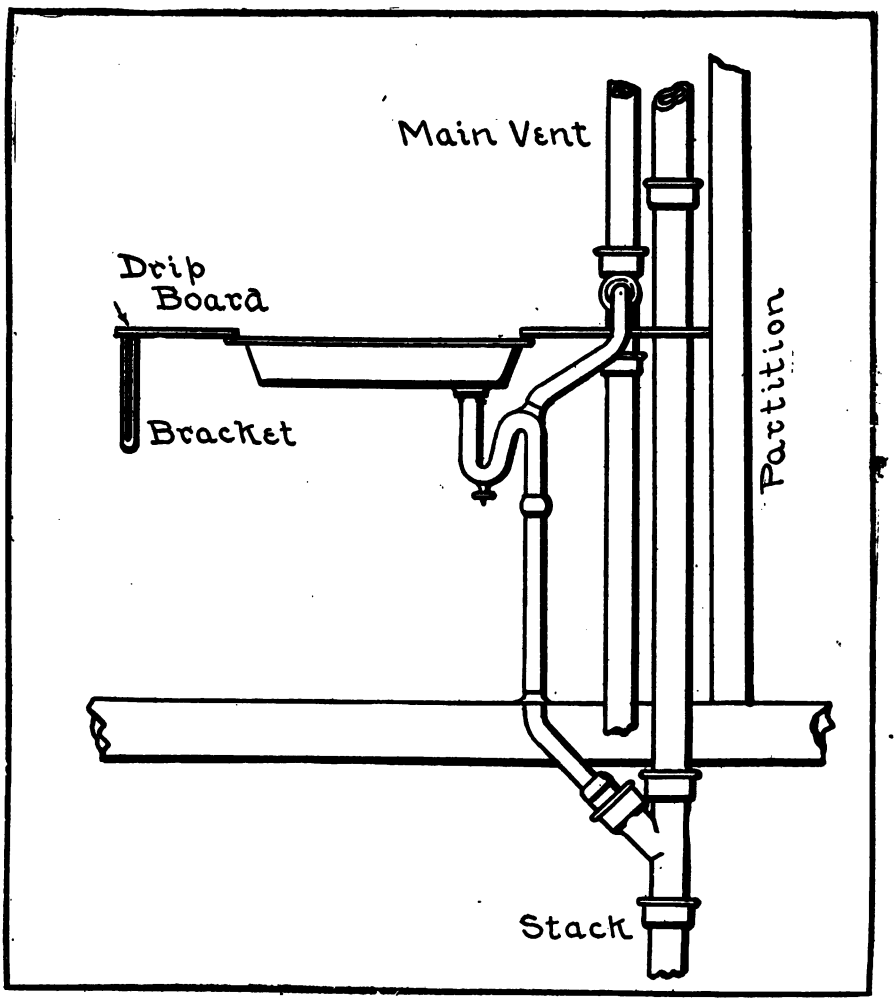

Figure 19—Showing an Elevation of a Common Kitchen Sink

These two drawings, if desired, may be taken as exercises.

The suggestions made concerning the five preceding sketches should be applied in drawing up Fig. 19. It can easily be seen that each of these views is equally necessary to the complete representation of the sink and its connections. Fig. 18

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shows the location of the sink more fully than Fig. 19, but Fig. 19 shows the connections more fully—the connection under the floor into the stack for instance, the height at which the sink is set, etc.

As we said in looking into the matter of projection as the fundamental principle of drawing, the plan (Fig. 18) is obtained by looking down onto the sink, and the elevation (Fig. 19) by looking directly at it, just as one would look at the front of a building.

This elevation is taken looking at the front of the sink as the arrow points. An elevation might as properly have been taken looking at the end of the sink, as the dotted arrow points. There are certain reasons, however, why the elevation which we show gives a better view than the other. If the elevation had been taken from the end of the sink, it will be noticed that the waste and vent lines would have come one in front of the other instead of side by side as the front elevation shows, and the trap and its back air pipe would not have shown broadside to us, as Fig. 19 represents.

Therefore, in this work, the layout of the work should be sized up first, and such an elevation chosen as will show the work to best advantage. There is another point to be observed from Figs. 18 and 19.

When drawn on the same scale as these two views are, and should be when possible, similar measurements taken on each should agree with each other. For instance, measure from the end of the lower drip board in the plan to the center of the vent line, and take the same measurement on the elevation. The two measurements will be found to be the same.

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CHAPTER IV.

WE have already stated, there are two views of any proposed piece of work that the plumber will need, if the work is to be shown fully. These views are known as the plan and the elevation, and each is equally valuable. The plan is sometimes called the top view, that is to say, this view, by whichever term it may be known, is obtained by looking down upon the object or the work, that is to be shown. Now in Figs. 20, 21, 22, and 23, we show drawings for an ordinary cottage house, such as are usually drawn up by the architect having the work in charge, and such, no doubt, as most of our readers are entirely familiar with.

These views are what the plumber usually figures his work from, and as a general thing he has no further drawing on his own line of work that he can look to for help.

Indeed, in a great many cases he does not need any further help. On the other hand, in a great many cases there is abundant use for a special drawing on the plumbing work of a building, and such a thing would often be of service to the plumber and to the architect and owner as well. If the architect had to work out in a drawing the way in which the different pipes, vent and waste would have to run, it would be the means of his giving more attention to the location of his fixtures, the laying out of bath rooms, the running of floor timbers, etc., and as a result, the plumber would find himself able to put in his work to better advantage, with less cutting, etc., than he is usually able to do under present existing and undesirable conditions.

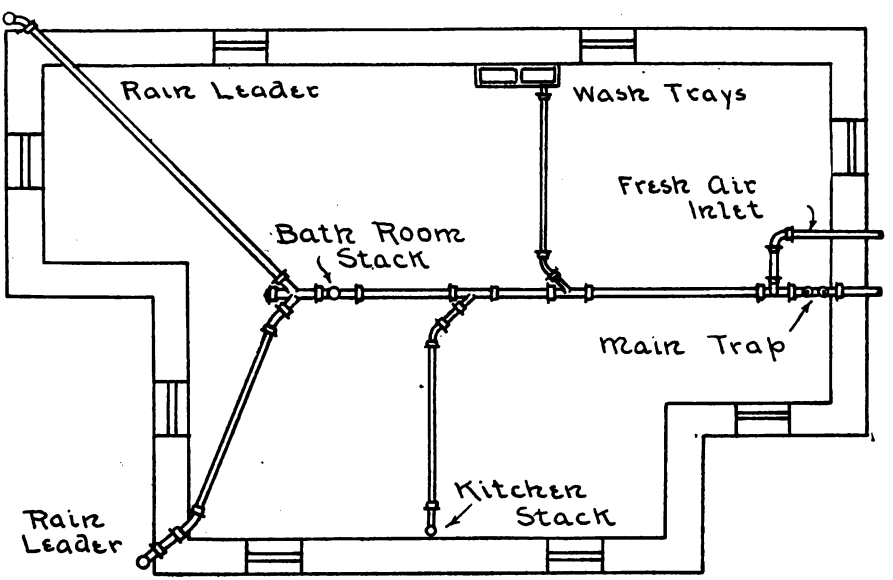

Fig. 20—Showing Cellar Plan. Scale ⅛-inch to 1 foot.

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Fig. 20 shows a cellar plan, with the pipes running as they are to be put in. This is a view that is very important, the plumbing system as we are supposed to do when making this view, we shall see only the ends of pipes that run ver-

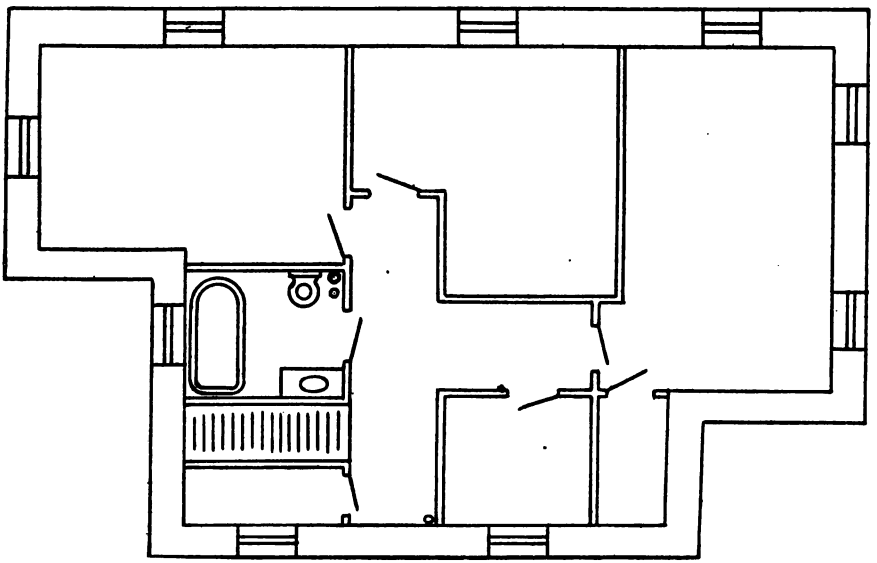

Fig. 21—Showing Bathroom Connections on Second Floor. Scale ⅛-inch to 1 foot.

one that will almost always be required when drawings of the plumbing work are desired.

That two stacks that pass up through tically, and as may readily be seen, these ends will appear circular. Now when we come to study the first and second floor plans, each gives, or should give,

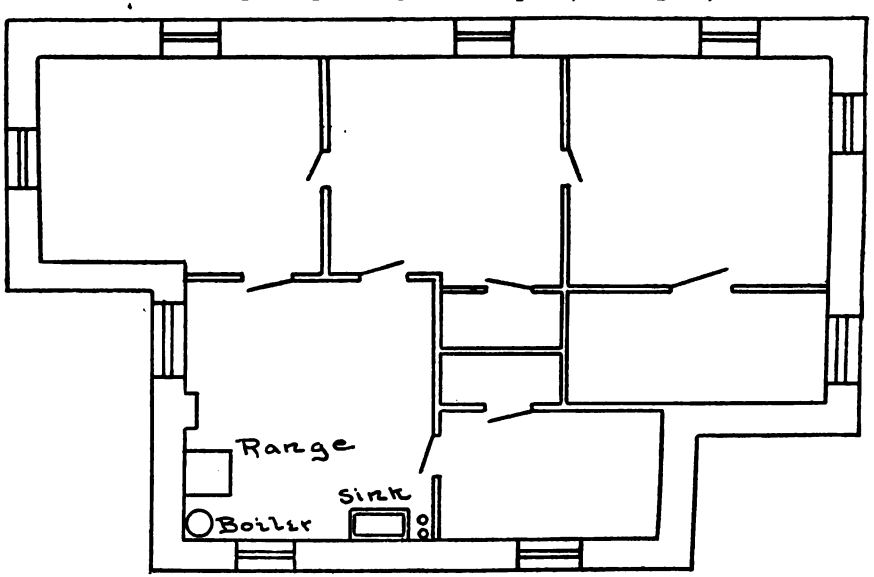

Fig. 22—Showing First Floor Plan. Scale ⅛-inch to 1 foot.

the house, and through the roof, are shown in this view or in any other plan view by circles, for in looking down on the location of all fixtures on that particular floor, also the location of any stacks that may pass up through said floor.

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In comparing these floor plans with the cellar plan, if it is found that the position of the stack as the circle shows it, is located directly over its position in the cellar, it is clear that the pipe runs vertically without offset.

If the positions do not show this, but it is found that the locations vary, then we know that there is an offset.

It would be first-class practice for any one following these articles, to take the set of plans which we illustrate, and work out the same on a larger scale, or better still, to change the layout and locate the stacks in their proper positions on the several floors.

The drawing of a cellar plan, with the pipes showing, as we submit in Fig. 20, is especially desirable work for the beginner, and not too difficult for him. We therefore suggest that he give particular attention to perfecting that view. It will be noticed that these four views are each drawn on a scale of ⅛ inch to the foot. To those who do not understand clearly what is meant by a scale drawing, we would make the following explanation: It is obviously impossible to lay out any view of an object of as large size as a house in its actual size. In this event, it is customary to choose some certain measurement, and let such measurement on the drawing represent some larger measurement on the object itself. Thus, in these floor plans, if we find a certain measurement to be ⅝ inch, we know from the scale that we are using, that the same measurement on the house itself is 5 feet. Various scales are in use, depending on the size of the building usually.

On ordinary work, the scale generally used is ¼ inch to the foot. On large work ⅛ inch to the foot is common. This brings to mind the fact that in working or figuring from plans care must be taken to do such work with the scale that the drawings are made on. The writer has heard several times of people who have made such a mistake as figuring the work from plans drawn on a ⅛ inch scale at ¼ inch scale, thus figuring only one-half the necessary lengths of pipes a fifty per cent. loss.

Now if any of our readers wish to e
large these plans as we have suggestc
and draw them on a larger scale, it c
easily be done. If it is desired to mal
the drawings four times the size shov
by us, they would then be on a scale
½ inch to the foot, and every measur
ment on our drawings would have to l

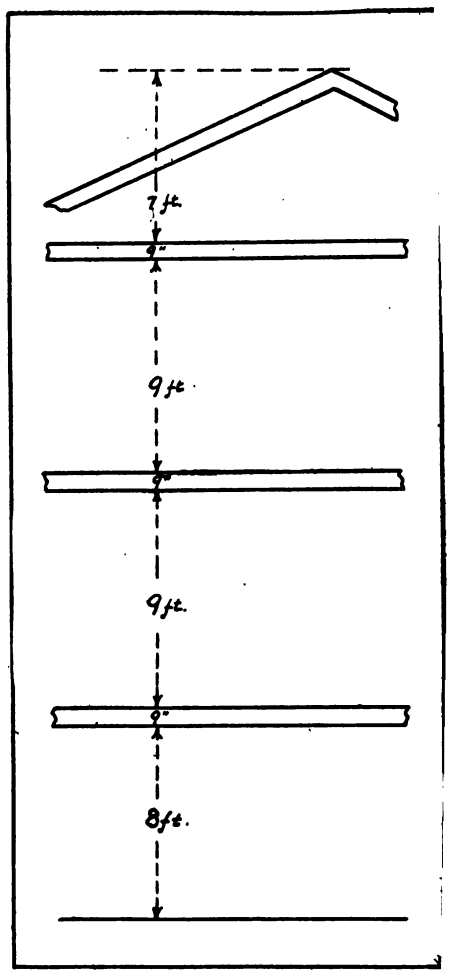

Fig. 23—Showing Elevation. Scale ⅛-In. to 1 f

made four times as large in the ne
drawing.

Fig. 23 we have scarcely referred t
as yet. It represents a very simple el
vation of the house shown in plan on th
three other views, and is not meant t
represent in any way, the finished elev
tion that the architect usually prepare

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It simply shows the heights between floors, etc., and really represents all that the plumber needs so far as the elevations generally given by the architect are concerned. From the elevations given by the architect, unless indeed, they are

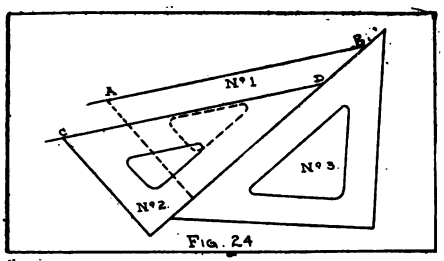

Fig. 24

elevations of the plumbing work itself, the plumber gets no other help than the several heights which will help him in figuring his vertical lines of pipe, etc. Now, before bringing this chapter to an end, there is one bit of instruction that we should give, and it will be helpful in laying out a part of the work shown in the cellar plan. The point to which we refer, is the running of lines at an odd angle, so that they shall be parallel to each other, as for instance, either line of conductors, which run at an angle with the main line. Of course horizontally and vertically, it is not difficult to get lines parallel, for all that is necessary is to move the tee square or triangle from one position to another, at the required distance apart from the first line. The way in which the result is reached when the lines are neither horizontal nor vertical, but as some angle between, may best be described from Figs. 24 and 25. Suppose in Fig. 24 the line A B has been drawn, and it is desired to draw a second line parallel to it. To do this, place one of the triangles in the position which No. 1 has, with one of its edges matching up with the line AB. Then place another triangle No. 3 against No. 1 triangle, as shown. Now, holding triangle No. 3 firmly in place, move No. 1 along to a second position, shown by No. 2, when line C D can be drawn parallel to A B. Any number of parallel lines can be drawn in this way.

It does not matter how the triangles are put together, so long as one can move along on the other. Thus in Fig.

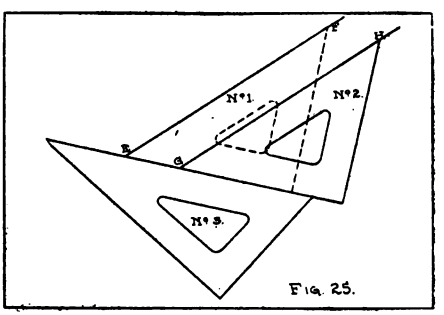

Fig. 25.

25, the two triangles are placed differently, but the lines E F and G H can be drawn parallel in just the same manner. This method of drawing parallel lines should be kept in mind, for it is the practical way of doing such work.

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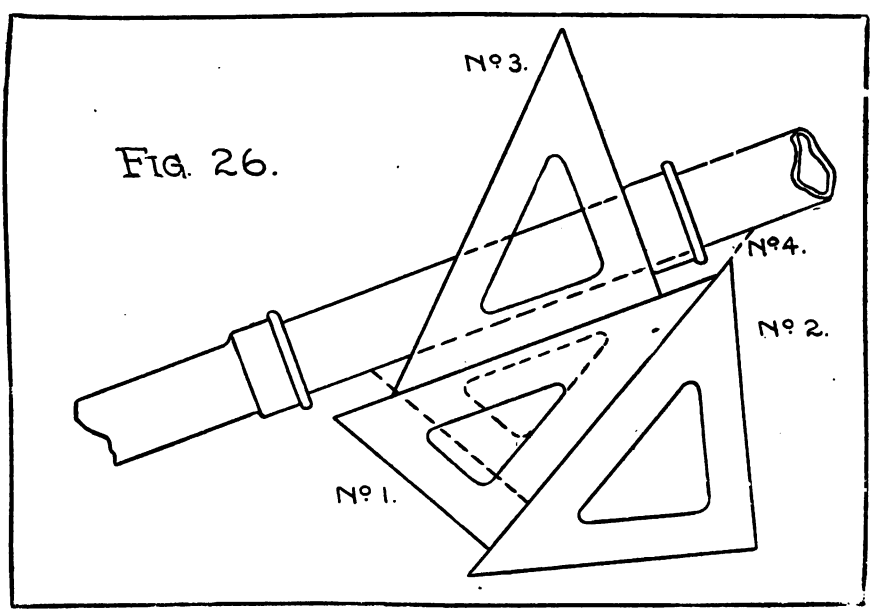
CHAPTER V

THIS method would be made use of in representing runs of pipe at oblique angles with the main. After having shown such a line of pipe, it is necessary to show the hubs on pipe and fittings, and the lines representing the hub are of course at right angles to the direction of the pipe.

Referring now to Fig. 26, let us suppose the two parallel lines representing the pipe have been drawn at some odd angle, and it is desired to put in the perpendicular lines showing the hubs. We will suppose that the lower line on the pipe has been drawn by placing the triangles. No. 2 and No. 4 together, and following the method explained above. Still holding No. 2 in position, draw No. 4 along the edge of No. 2 into a new position away from the line just drawn. This new position is shown by No. 1.

Now holding No. 1 firmly in its new position, place No. 2 triangle in the position shown by No. 3, with one of its edges at right angles to the line of pipe, as it must of necessity be.

It will be clearly seen that by sliding No. 3 along No. 1, lines at right angles to the direction of the line of pipe can be drawn at any desired point. It has taken quite a few words to explain this method, simple as it is, and it is a good example of the difficulties in carrying on a course of this kind in any other way than by oral demonstrations. An instructor could explain a great deal to the pupil before him very quickly, whereas the writing of the same explanation demands of the one



Method of Drawing Lines Perpendicular to Each Other at Right Angles.

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following our instructions very close attention, if he is to get full benefit from his study.

However, we try to make our explanations as clear and simple as possible, and believe that those following these articles closely can derive much benefit from the knowledge of the subject gained.

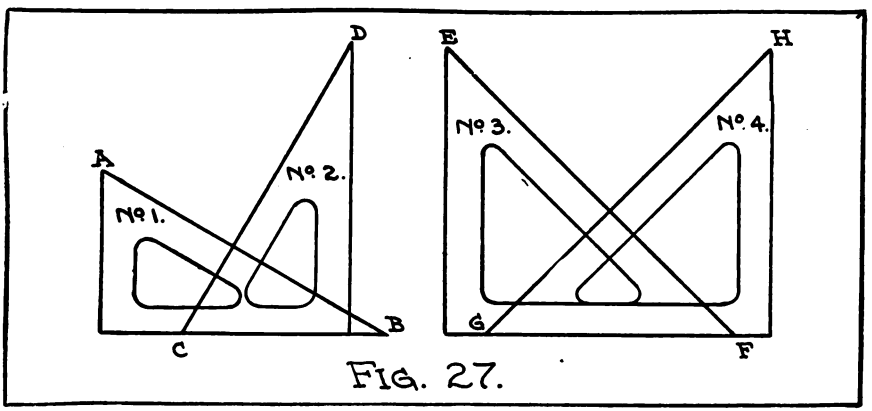

FIG. 27.

Another Method of Drawing Lines Perpendicular to Each Other at Common Angles.

If two lines are to be perpendicular to each other at common angles, such as 30 deg., 45 deg. and 60 deg., the problem is simple, and may easily be seen by reference to Fig. 27.

The line A B is drawn at 30 deg. with the horizontal, and can be obtained simply by drawing a line along the edge of the 30 deg. triangle placed against the tee square. To obtain a line at right angles to A B just reverse triangle No. 1 to the position of No. 2, and the line C D will be the line desired. It is the same with the 45 deg. triangle. In Fig. 27 if it is desired to draw a line at right angles to line EF, reverse triangle No. 3 to the position of triangle No. 4, and the line G H will be the line desired.

This latter statement may often be put to use, as we may see from Fig. 28. In making drawings of plumbing work, it is far oftener the case that a branch is taken from a horizontal or vertical line of pipe than from a line running at odd angles. A regular Y branch is always at an angle of 45 deg. with the main line of pipe. Therefore, in laying out work, such as shown in Fig. 28, the main pipe is drawn in with the tee square, and the lines of the branch are drawn in with

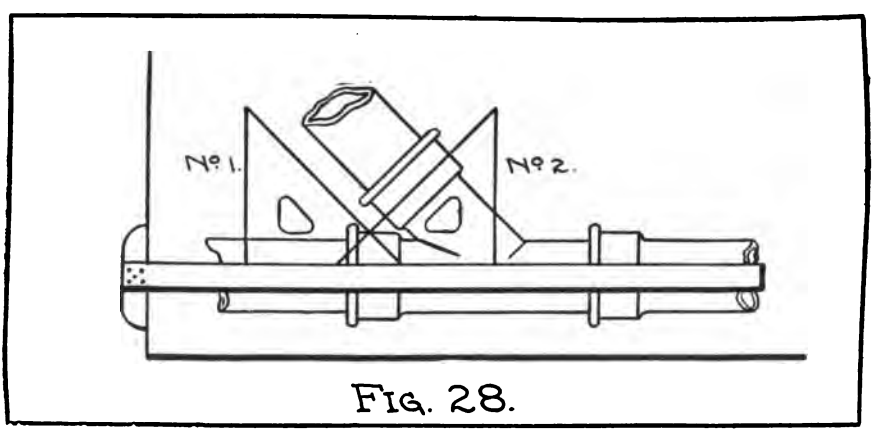

FIG. 28.

The Main Pipe Drawn With a Tee Square—Lines of Branch With 45 Degree Triangle.

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the use of the 45 deg. triangle in position No. 1. Lines representing the hubs are put in with the same triangle in position No. 2.

In Fig. 29 we show right and wrong methods for drawing quarter and eighth bends, and in Fig. 30 like methods for running traps. We do this in order to show our readers some of the mistakes which it is natural for a beginner to make, and which he can the better avoid after comparing wrong constructions with correct. The common quarter bend is a compact fitting as No. 1 will show, and the mistake often made is in giving it the long sweep shown in No. 2, although there are special fittings made after the manner of No. 2. The same fault is often found in the drawing of eighth and other bends. In drawing the quarter bend, first run the horizontal and vertical lines, then with the compasses set on a center close to the intersection of the two inside lines, describe the curves so that they will run smoothly into the respective lines. Of course both curves are struck from the same center. Many times the eighth bend will be used between a Y branch and a straight run of pipe. In this case, draw in the lines for the Y branch and the straight line, then connect these lines with the proper curve. Not until this is done should the hub on the branch or on the bend be drawn. Now with reference to

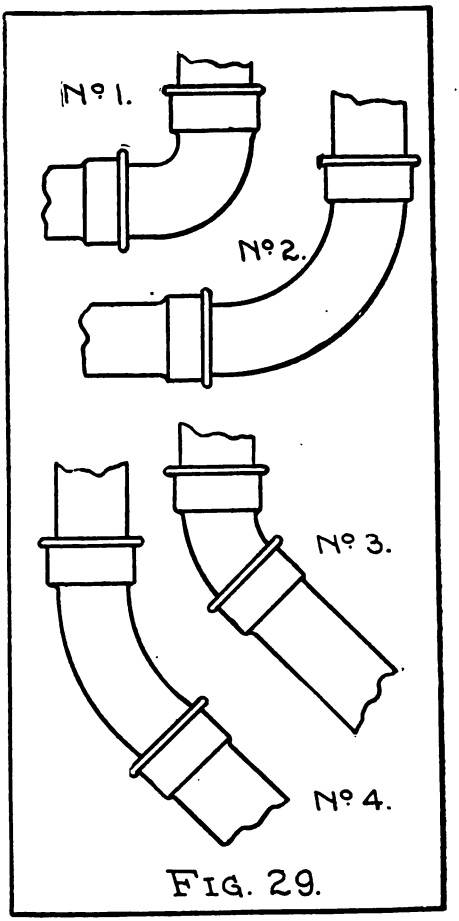

FIG. 29.

Right and Wrong—Quarter and Eighth Bends.

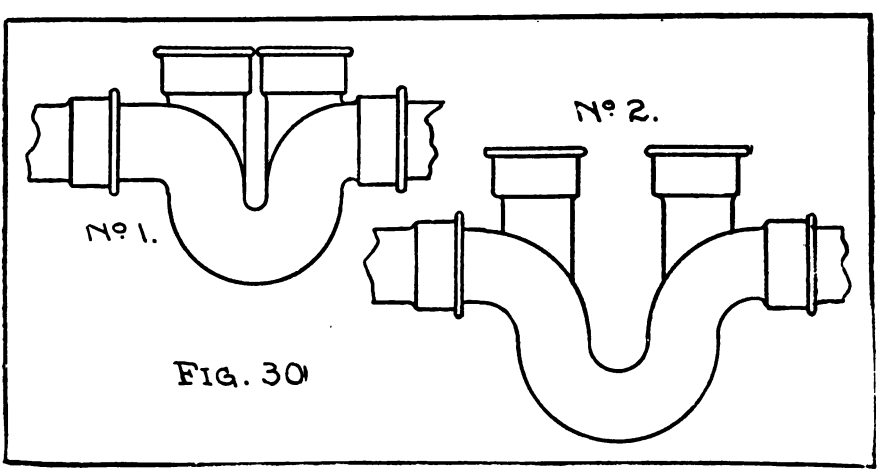

FIG. 30

Showing How Curve of Trap is Made Too Low Down.

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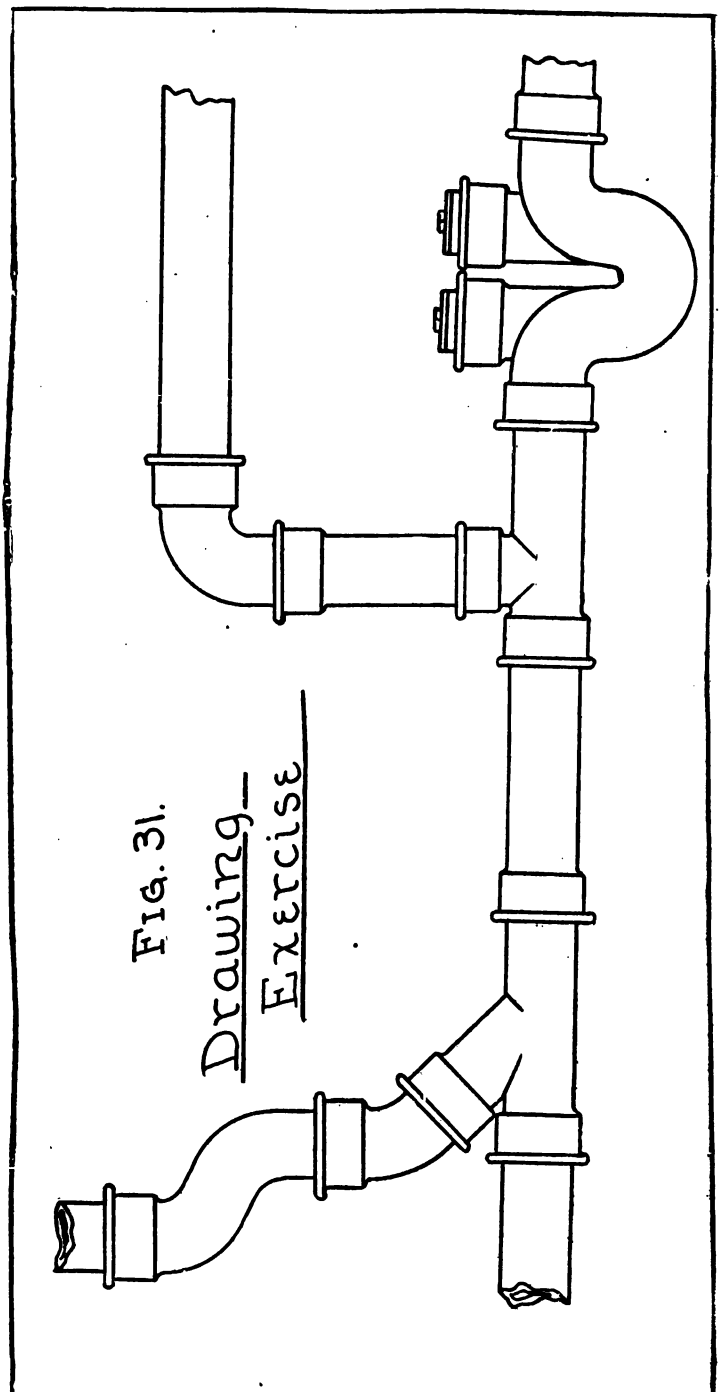

Model for Students to Work Out—Combinations of Pipe and Fittings as we give it. This should be drawn on same scale, at least no smaller.

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the running trap of Fig. 30. The common fault in drawing this fitting is to make the curve of the trap too low down, that is, to give the trap a much deeper seal than is it really has. Another fault shown in No. 2 as compared with No. 1, is the length of the straight lines connecting the vent hubs with the trap. As seen in No. 1, these hubs set close to the trap, and are close together. We have taken up the construction of these particular fittings in order that use may be made of the instructions given in working out the exercise in drawing which we give in Fig. 31. We would suggest that with this figure as a model the student work out the combination of pipe and fittings as we give it, and on the same scale, or at least no smaller scale. We believe, by applying the instruction which we have already given, that the beginner will be able to work this exercise out without much difficulty. To start with, run the main line of pipe right through, regardless of fittings, giving it a slight pitch, as it would naturally have. Then put in the trap, and work back. In using the lead pencil do not bear down so heavily that when it comes to erasing lines later, to show in the fittings, the lines cannot be entirely erased. We should have stated previous to this that a hard lead pencil, preferably 6H, should be used, as it makes much cleaner work than a soft pencil. The very small curves, such as seen on the heads of hubs may best be put in by hand, rather than with instruments.

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CHAPTER VI

THE making of complete elevations of plumbing systems is one of the most important points of the subject which we are studying, and even though we are hardly able as yet to make such drawings, it will be well for us now to consider the general points in connection with them.

The only requirements for making these views are the plans of the several floors

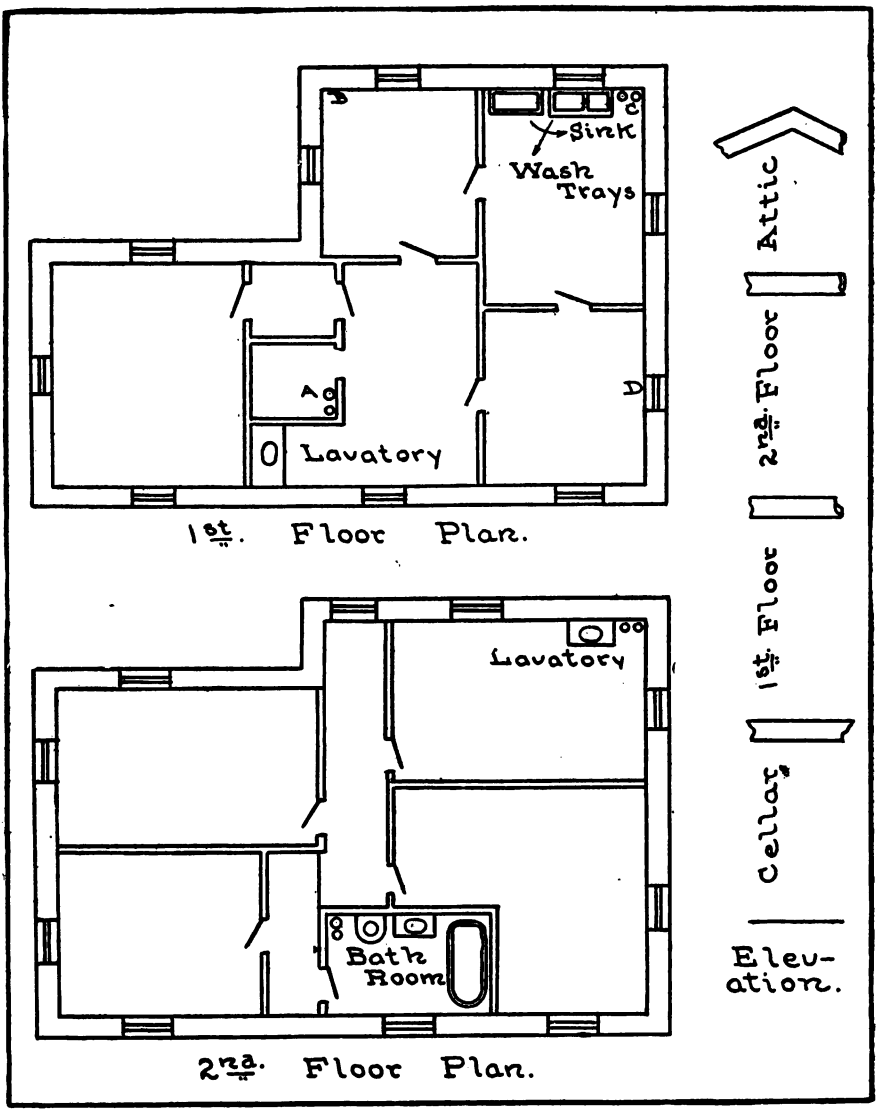

Fig. 32—Floor Plans of First and Second Floors.

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such as are ordinarily submitted by the architect and an elevation of the building, from which the heights between floors, etc., may be obtained.

The elevation, whether it be of the

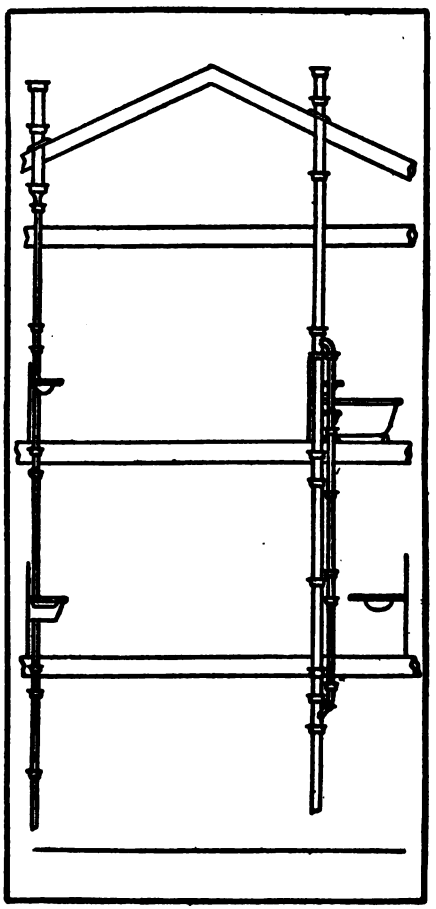

Fig. 33—Front Elevation of Plumbing.

house itself, or of the plumbing, may be taken either from the front or from the side.

In Fig. 32 we give the floor plans of the first and second floors of a residence with a plan elevation showing heights.

The cellar plan is not necessary for the making of the elevation ordinarily, for the elevation cannot usually show the pipes on the cellar bottom to such good advantage as the cellar plan can.

In Fig. 33 we give a front elevation of the plumbing for the house as shown in Fig. 32, and in Fig. 34, the side elevation.

As the front of the house we take the end to the left, and the front elevation (Fig. 33), is taken by viewing the work from that point.

The side from which the work is viewed for the side elevations is the side on which the bath room is located. This side view might be taken from the side opposite if desired, and would be as correct a side elevation as the one we have taken.

While not always so, in the present instance the floor plans and plumbing elevations are made on the same scale.

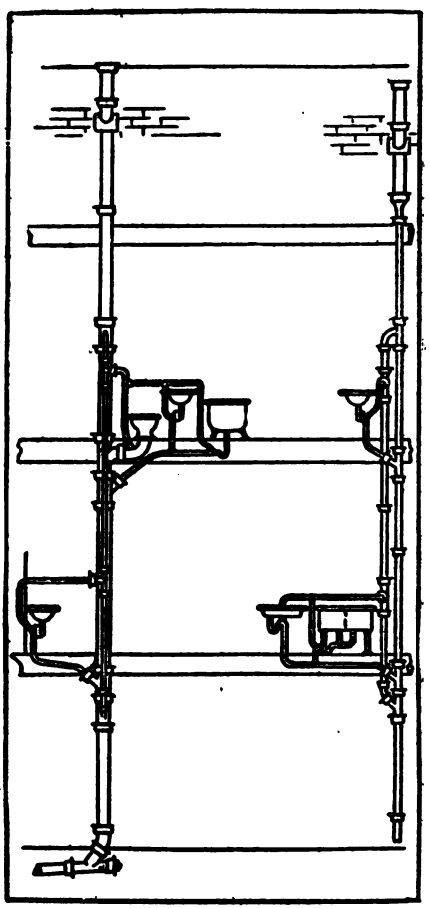

Fig. 34.—Side Elevation of Plumbing.

In order to be correct then, distances between certain points on the floor plans must be the same on the elevation. Therefore, in laying out the front elevation, the first thing to do is to lay out the two

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main lines of vertical pipe at a distance apart from each other equal to the distance between the two pipes which a view

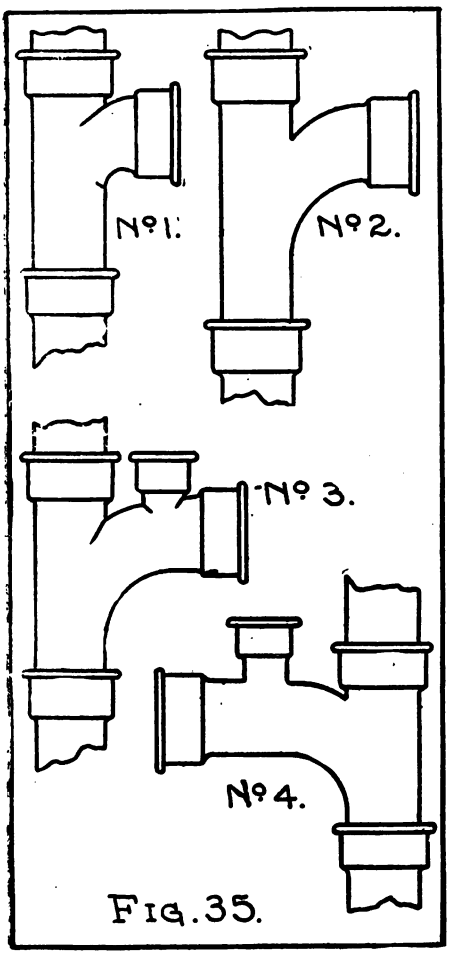

FIG. 35.

Correct and Incorrect Drawing for Fittings.

of the house from the front would give.

We wish to make ourselves very clear on this point, as the beginner in drawing often makes a mistake right here. The actual distance between the two lines of pipe as shown in the first floor plan, is the distance from A to C, but in viewing the work from the front, the distance will appear as the distance across from A to B. In the same way in the side elevation the distance between the two pipes will not be the actual distance from A to C, for a view taken by looking at the work from the side will make the distance appear as that from A to D.

If these facts do not explain themselves readily to our readers, we would advise them to refer back to what we had to say on projection. We have brought it up at this point in order that our readers may get the idea somewhat in their minds, but shall take it up more thoroughly at a later point in this book. In the same way that the distance between pipes is laid out, other measurements are taken. Thus, looking from the front for the front elevation (Fig. 33), we find the lavatory shown on the first floor plan to be at the right of

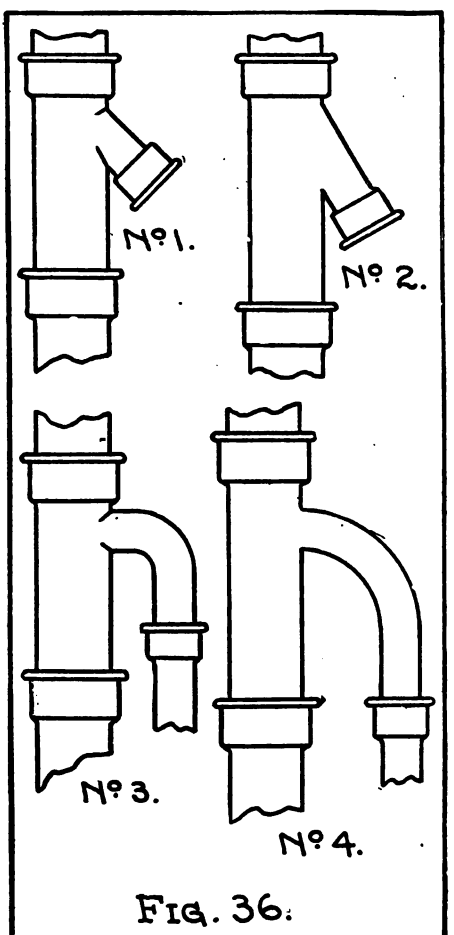

FIG. 36.

Another Correct and Incorrect method of Drawing for Fittings.

the stack A. Therefore in the elevation, locate it at the same distance to the right of the stack as shown on page 31.

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The plans and elevations of any piece of work must always be consistent. Otherwise, they are of no value. The plan of the lavatory just referred to shows that it is set away and from the stack in a certain manner, this we cannot show nearly so well in the elevation. The latter view shows how high the fixture is set, etc., which the plan cannot show. Each view then has its own special use and value. Now let us compare the two elevations. We shall see that the front elevation is far less clear than the side, and so thoroughly is this true, that we have not shown in the connection for the separate fixtures on the front elevation. In the bath room and kitchen the fixtures come in front of each other, and if we should attempt on this small scale to show all the connections, the work would be so confused and mixed up that it would be useless.

The side elevation, however, shows everything clearly. The comparison of the two elevations makes it clear then, that in making an elevation of the plumbing work of any building from the plans, we should be careful to select that elevation which will show the work most clearly. Indeed, it is sometimes necessary to show one stack as a front elevation, and another on the same work as a side elevation. This we shall consider later on.

In Figs. 35 and 36 we give correct and incorrect methods of drawing certain fittings. No. 1, in Fig. 35, shows a T-Y.

The branch is actually a short one and not carried on a wide sweep, with the branch, but so far out as No. 2 shows. The depth of hubs should be about two-thirds the diameter of the pipe.

The vented T-Y is shown in its correct form in No. 3, and should not be made as in No. 4 with the branch hub too far out, and with the branch too leved. The vent hub should be on the same level as the main hub on the fitting.

In Fig. 36 the branch of the inverted Y should be made at 45 deg., and not at 30 deg., as shown in No. 2. No. 3 shows the correct form of the vent fitting used in connecting the main vent back into the stack. The hubs should not be on the same level as No. 4 shows, and the

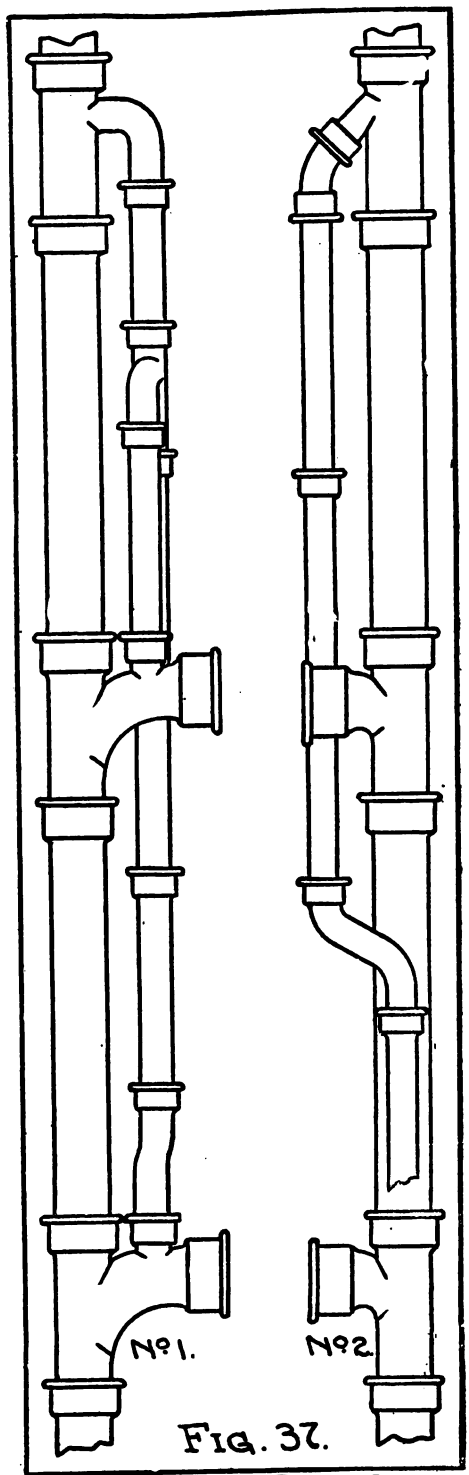

Fig. 37.

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branch should run out straight for a little distance and not start to curve at once from the main part of the fitting. In Fig. 37 we give two exercises in drawing which combine the several fittings shown in the two preceding figures. We would advise some little practice on the work shown in Figs. 35 and 36, and then practice on the work of Fig. 37.

In No. 1 the vent from the upper vented T-Y is shown offset into the main vent through a vent T turned slightly from its straight position. In laying out these two exercises, first put in the two main lines of pipes without hubs, the line of vent being shown nearly its diameter away from the other pipe. The side elevation will receive attention next.

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CHAPTER VII

IN the preceding chapter we showed front and side elevations of the plumbing of a residence, and noted the fact that the side elevation was by far the clearer, consequently the more valuable of the two. These views were drawn on the same scale as the floor plans, and as may have been evident to our readers, this scale was so small that it was more or less difficult to trace out the work, and that the smaller details could not be clearly shown. In Fig. 38 we show the principal part of the side elevation men-

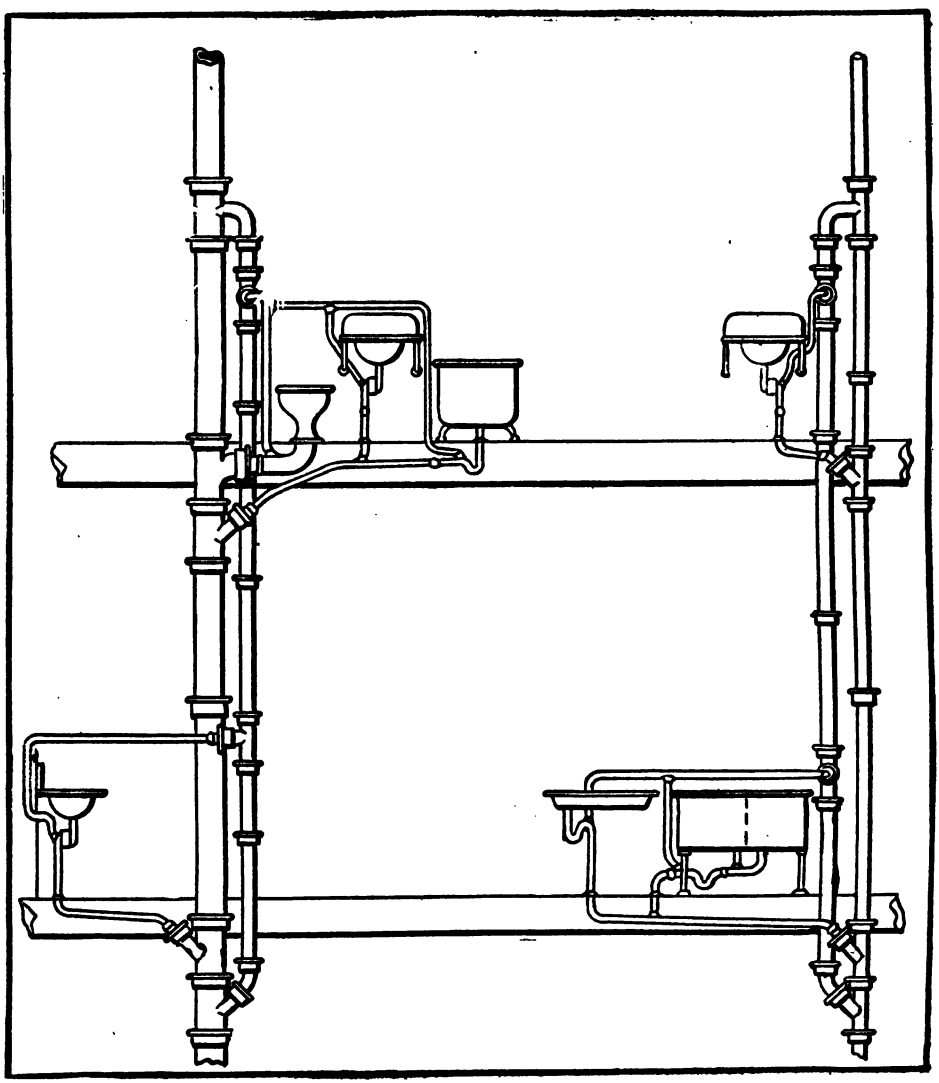

Fig. 38—The Principal Part of Side Elevation Mentioned, Drawn Double Size.

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tioned, drawn on a scale of double size.

It will be noticed how much more clearly the work appears. The wiped joints for instance, can be more clearly shown, the beads on the soil pipe hubs, etc. All these minor points go to giving character to a drawing and it is always well to show them.

We would therefore strongly advise our readers against making their drawings on too small a scale. Fig. 38, while double the scale used on the elevations shown in Chapter 6, is too small, and we should have made it larger, but for the necessity of economizing space. The smaller the scale on which a drawing is made, the more difficult, the more puttering the work will be, and it has been the experience of the writer that beginners often discourage their own efforts by drawing their work too small. Another point in connection with Fig. 38, to which we wish to call attention, is the manner in which the main line of back air for the bathroom stack is shown. In Fig. 34 of the previous article, it is shown directly in line with, and in front of the main stack, and this is of course the true position for it in the view in question.

Instead of following the absolutely right way of showing this line of pipe in Fig. 38 we have shown it at the side of the main stack. A comparison of the two views will show at once that the method followed in Fig. 38 gives a better idea of the way in which the work is done, than Fig. 34. This is particularly true concerning the connection of the main back air into the stack, above the highest and below the lowest fixtures.

In a great many cases, probably a large majority of them, it could make no practical difference whether the relative positions of the stack and main back air were as they are shown in Fig. 34 or as shown in Fig. 38. When this is the case, it will often be found of advantage to draw certain parts of the work as if seen in a different view than the rest. As a general thing, an elevation is usually given simply to show the general layout of the work, the way in which the fixtures are to be connected, etc., and for the location of fixtures the floor plans are made use of. Therefore, many times it is best to show such a view of certain

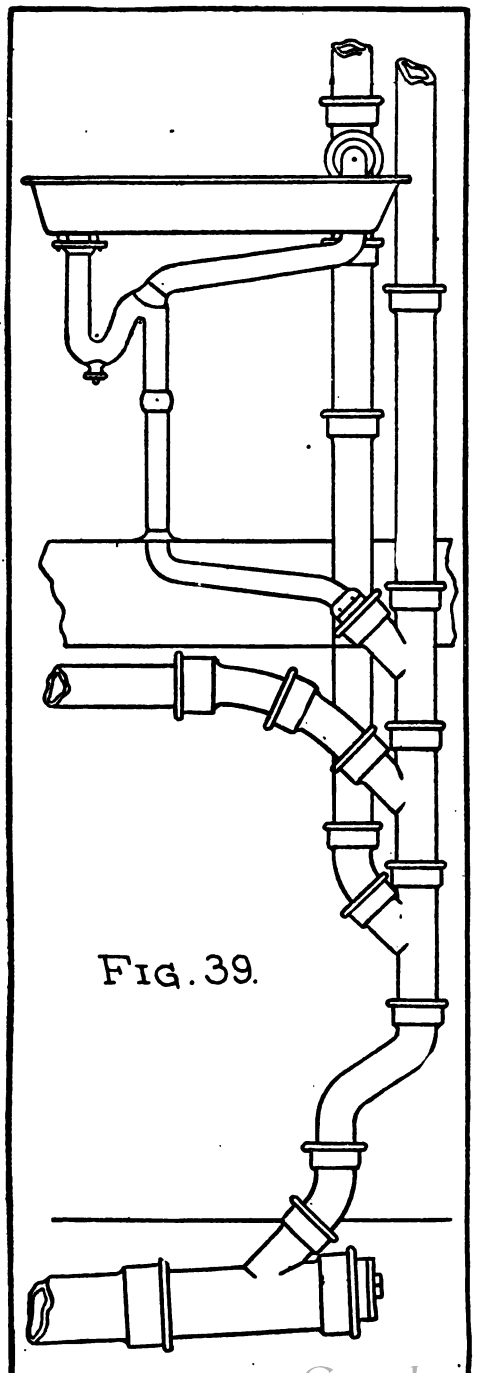

Fig. 39—A Practice Sketch

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parts of the work, as will be of the greatest assistance in giving a clear idea of the method of putting in the work.

In Figs. 39, 40 and 41, we give three exercises, which the student will do well to practice on faithfully. They are somewhat more difficult than those which have preceded them, though not too difficult. We would advise going over the work several times if necessary to get results that will be satisfactory, carefully comparing the work with that which we give, and noting where improvements can be made.

It will be noticed on each of these exercises that there are a number of dots. These dots represent the centers for the different curves, that is, the points on which the instrument must be placed to draw the curves correctly. We have done this for the reason that the beginner in drawing, often has difficulty in deciding how large a radius he must take for striking a given curve.

Wherever a pipe curves, both the inside and outside curves are struck from the same centre. This must be so of course, in order that the bend in the pipe may be of the same diameter at every point. The further off the center is taken, or in other words, the greater the radius, the greater the sweep the curve will have. Thus in Fig. 39, it will be noticed that a branch enters the vertical line of pipe just below the entrance of the waste from the sink, and that in doing so quite a wide sweep is made, the center for which is nearly an inch away.

This we should draw in the following manner: Put in first the Y branch, which will give us the direction the curve has got to take. Next draw in the lines representing the straight run of pipe just under the floor. Then connect this straight section with the Y by means of the curve. After this has been done, draw in the hubs, erasing such of the lines as are not needed. In drawing the straight section of pipe beneath the floor, do not try to stop the lines at the exact point where the curves will meet them, but put them in indefinite length, and erase whatever runs by, after putting in the curves. Now, in laying out these drawings, if they are to be made on a special scale, of course it will be necessary to work according to such scale

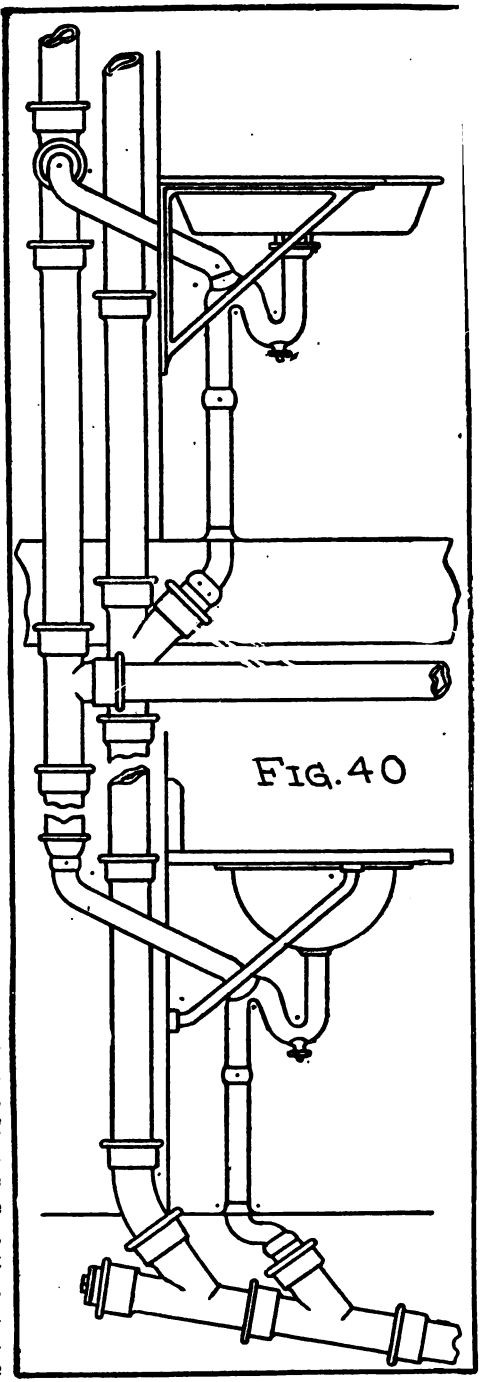

Fig. 40—Another Practice Drawing.

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but if the drawing is simply to show the general manner in which the work is to be installed, as would more often be the case in making plumbing drawings, then we need not be so careful in making the layout. We will suppose in the case of Figs. 39, 40 and 41, that no scale is required. Decide first on which side of the fixture the main waste and vent lines are to be run, then draw them without hubs, and draw the fixture in its position. Very often it is best as in the case of the sink in Fig. 39, to show the waste at the further end of the sink, as it can readily be seen that it would be close work to show it properly at the other end.

After having drawn the waste for the sink to the floor, draw in a general way the horizontal section of waste under the floor, with sufficient pitch, and from the course of this pipe it can be seen where the Y branch will have to be located. Then draw the Y branch beneath, and the branch line of pipe running into it, as explained above.

Now as to putting in the offset, it will probably be easier to draw in the main line into which the vertical branches, and come up with the bend, before putting in the offset. This method would usually be better, though in the present instance it does not matter particularly.

It will be noticed that in these exercises we have shown both sink and lavatory in two positions, one in which it is seen from the front, and the other from the end. This we do in order that the student may become accustomed to showing the work in whichever way it may be necessary. In the case of Fig. 41 we show an oval bowl. A side view of it, however, would not be materially different from the common round bowl.

In Fig. 40 it will be noticed that the

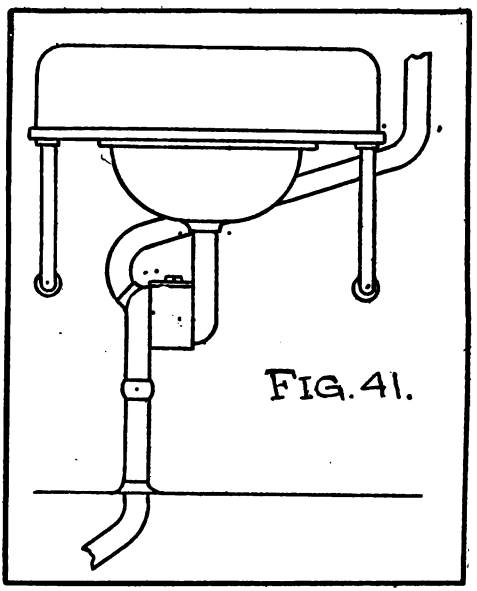

FIG. 41.

lavatory appears to set too close to the ceiling, and that the vertical lines of pipe are broken. It often happens that in order to economize space, fixtures shown in illustrations appear too close to the ceiling. Many times this is almost unavoidable if the work is to be shown on a good fair scale, and often in such cases, the pipes are broken off, to show that the full length or height does not appear.

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CHAPTER VIII

WE have given more or less space in this book to the consideration of drawings drawn to scale, and this brings to mind a suggestion along the same line, which may be of value. In Figs. 42 and 43, we show an elevation of bathroom work, with floor plan for the same. It will be noticed that the space on which these drawings have been made, is ruled off, into one-eighth inch squares. Paper ruled in this manner, and called co-ordinate paper, can be procured usually of stationers, and for the making of scale drawings is often very useful.

In Figs. 42 and 43, we have used a scale of ⅛-inch to 4-inches. In other words, each

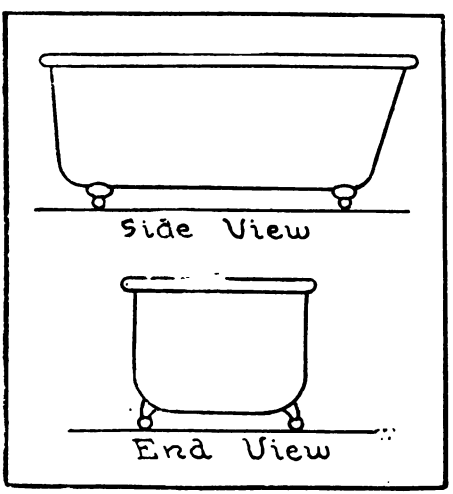

Fig. 44.—Showing a Side and End View of a Bath Tub.

one of the spaces, whether vertical or horizontal, represents 4 inch on the actual work.

Thus, the diameter of the soil pipe, 4 inch, takes up a single space; the 2 inch pipe takes up in diameter, half of one of the spaces; the height of the back to the lavatory is 10 inches, the height of the ceiling from the bathroom floor is about 10 feet, etc. These spaces might just as properly represent 2 inches or 8 inches or any other dimension. It is always best, how-

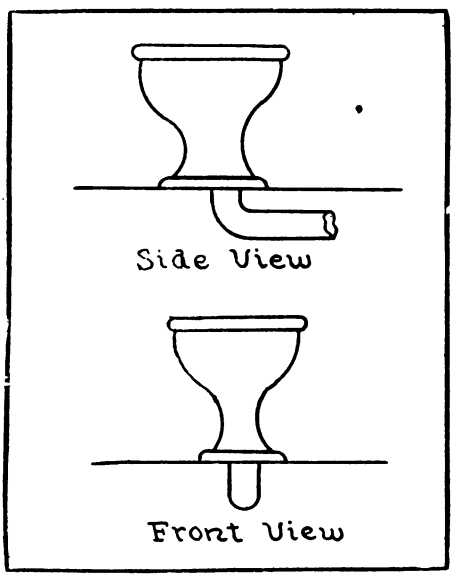

Fig. 45.—View of a Water Closet.

ever, to make the scale just as large as the amount of work to be shown, and the size of the paper will allow.

It is probable that many of our readers in different parts of the country are already familiar with this method of laying out drawings, for many boards of health require such drawings as we show in Figs. 42 and 43, and supply paper ruled in this very way, on which the drawings are submitted.

Most of the practice work which we have heretofore presented in this book, has been on soil pipe work. We have reached

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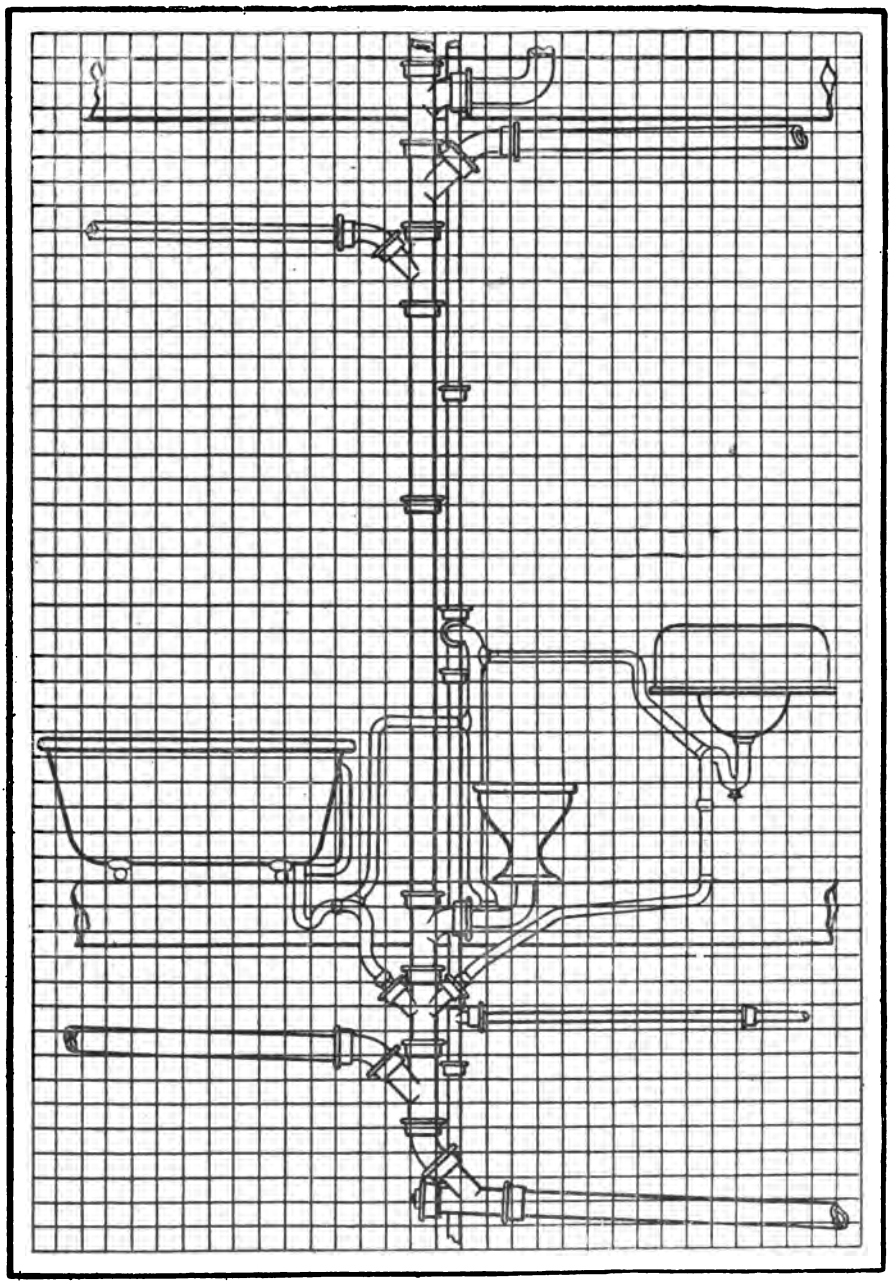

Fig. 42.—Each of the Spaces, Vertical or Horizontal, Represents 4 in. on the Actual Work.

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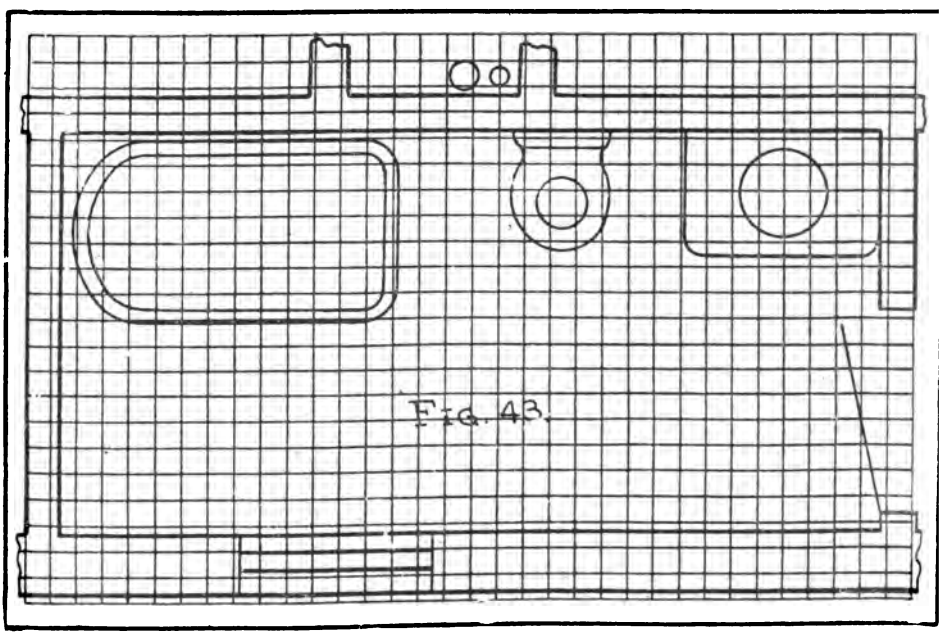
a point now, where we need to be able to draw the different fixtures, and we therefore show in Figs. 44, 45, and 46, some of this work.

In Fig. 44 we show a side and an end view of a bath tub, for we must be prepared to show this or any other fixture in either position.

Fig. 45 gives views of a water closet which is general in shape, and unless some particular type is to be shown on a drawing, this form we believe, will be found easier to draw than most any other. For the different views of these fixtures, and would advise practice in constructing them, first, on the same scale that we show, and then on a larger scale, as it is of course necessary to be able to draw work in any size, and not well to practice continually on the size which we give in the exercises.

After devoting some time to the above practice, we would ask our readers to take up the work shown in Fig. 47, which brings into use the fixtures we are now familiar with, and in certain ways is



Showing a Scale of 1-8 inch to 4 inches, same as in Fig. 42.

some reason or other, the washout water closet shown in Fig. 46, often appears in plumbing drawings. While saying nothing as to the excellence of this particular type, or otherwise, it is a difficult matter for the beginner in drawing to show it properly proportioned. The incorrect view of Fig. 46 will serve to show some of the common errors made in illustrating this style of closet, which our readers will observe by comparing the same with the upper view.

We have indicated by dots, the centers of the several curves necessary in drawing somewhat more difficult than preceding exercises. Skill in the drawing of plumbing work is simply a matter of practice, and we therefore again urge upon those following this series, to put in as much practice work as possible. If Fig. 47, or in fact any other work which we present, is on too small a scale for our readers to work easily, with the knowledge of the subject which they now possess, we would advise them to enlarge the size, say to double that which our work shows. It will be noticed in Fig 47, that the Y branch into which the bath and lavatory on the

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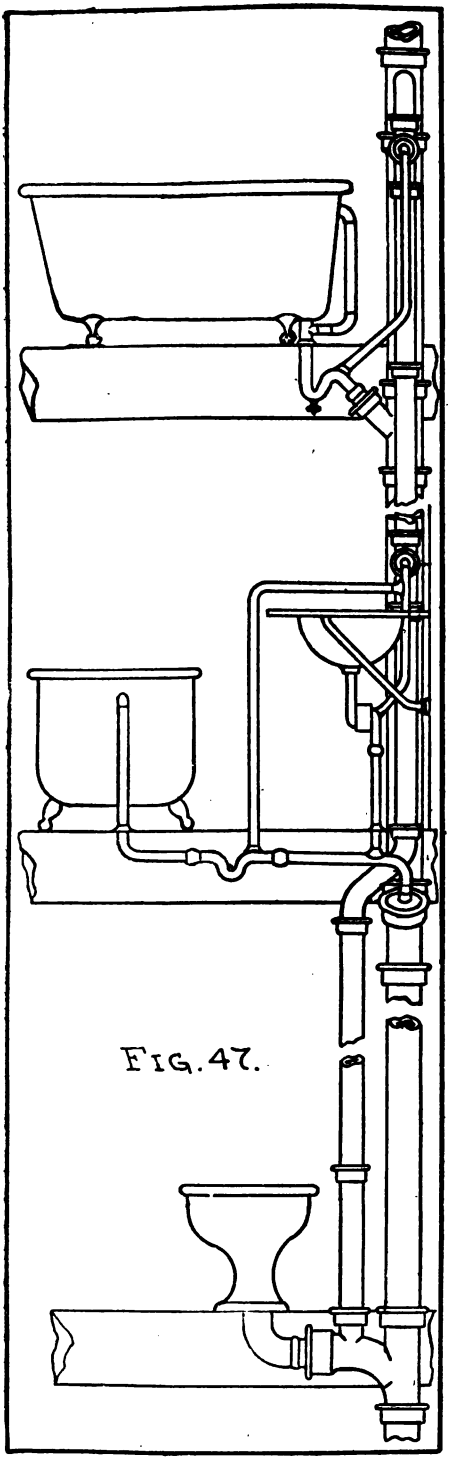

A More Difficult Exercise.

second floor enter, faces toward the front, in which case, we have the view which appears. The two vent tees also face the front, so that the tee branch does not appear, merely the circular form of the end of the branch.

Again, the upper fitting in Fig. 47, through which the vent line enters the stack, stands with its branch facing the front, and does not show the true shape of it, such as we have previously given in a preceding chapter.

As we have already stated, in making these drawings, we must be able to show fittings and fixtures in any position that we happen to meet, and while it is best to show them to the best advantage, it is almost impossible to show every feature of a drawing of any extent, as we would desire.

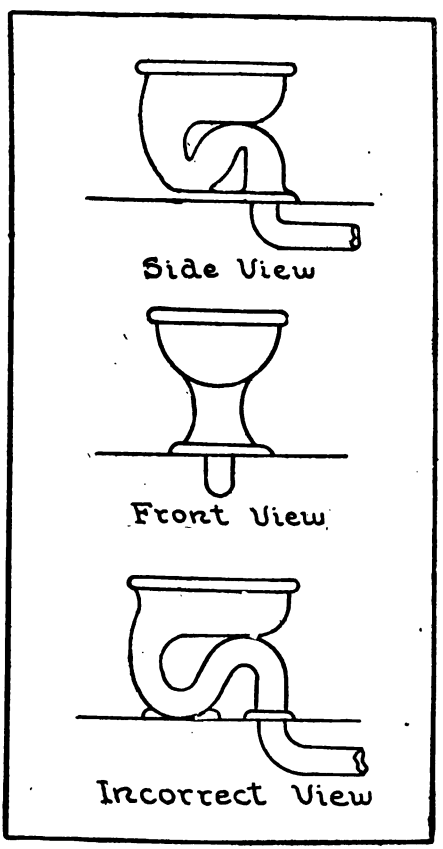

Fig. 48—The Drawing of Washout Water Closet.

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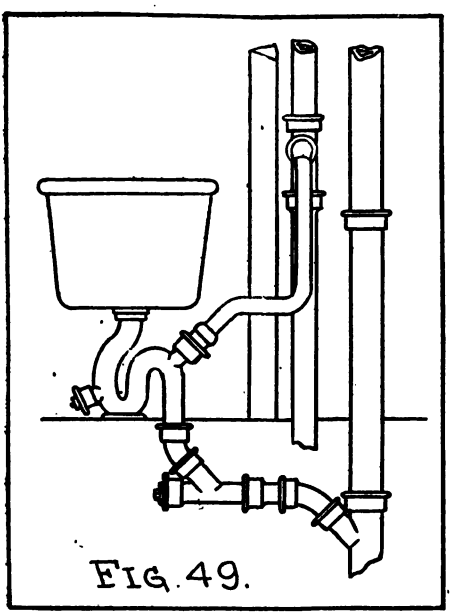
CHAPTER IX

WE have previously shown the proper forms for constructing some of the common fixtures. To these add in Figs. 48, 49, and 50, the urinal, slop hopper, and refrigerator. In these, besides showing the fixture itself, we have shown its connections also. We think this a good idea for the reason that some of our younger and more inexperienced readers may thereby be gaining a knowledge of sanitary methods, while gaining a knowledge of the subject of plumbing drawings.

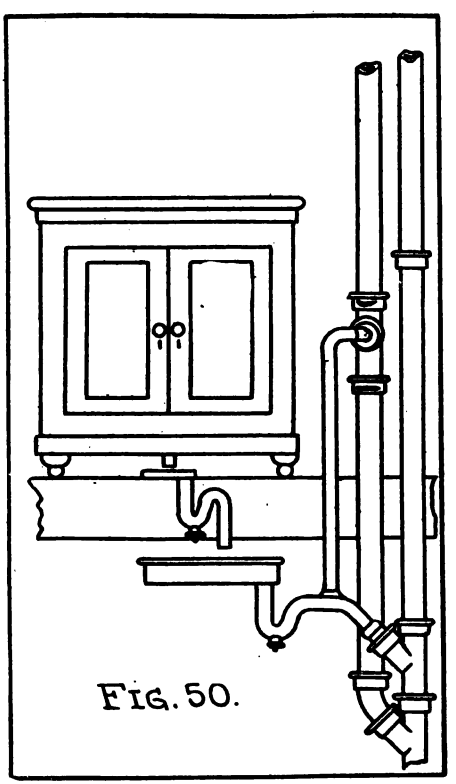


The Drawing of a Slop Hopper.

The three sketches above mentioned are presented as practice exercises, and interested readers cannot do better than to put in a good allowance of time in working on them.

In Fig. 48, the urinals are shown in two positions, as seen from the side, and from the front. The front view of this fixture, will be found rather difficult to draw, and to make it as easy as possible, we have dotted the centers of the principal curves used in constructing it. By placing the compasses on the different centers, and seeing which curves would probably be struck from the different points, we think it can be worked out satisfactorily.

In practicing on this work, it may be advisable, as we have previously suggested, to work on a larger scale, if the



Drawing of Refrigerator and Connections.

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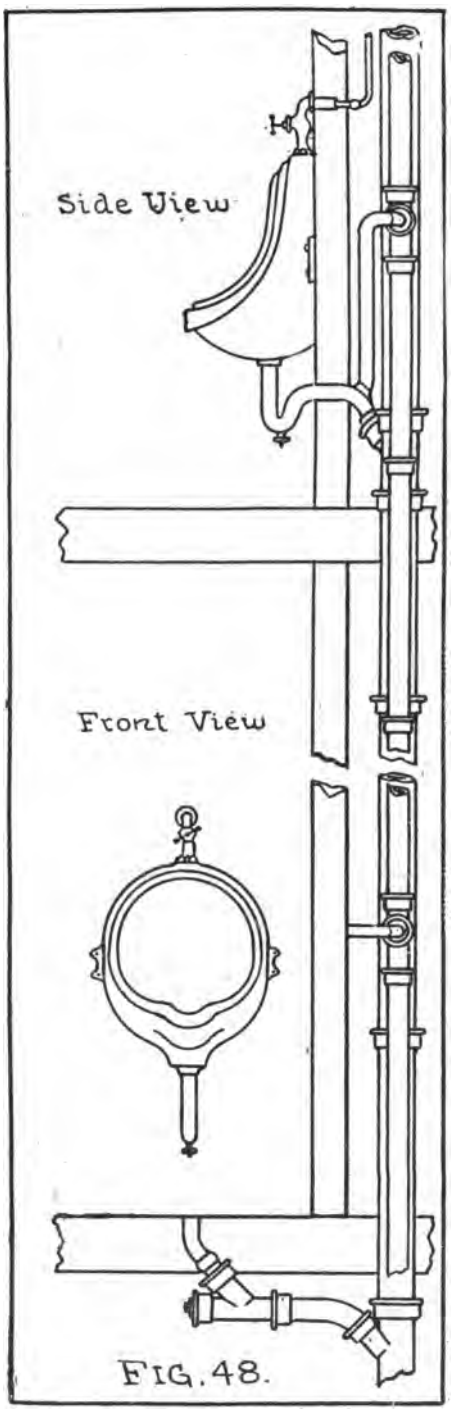

Drawing Showing Urinals in Two Different Positions.

scale on which plans are illustrated is too small to work easily.

In drawing the front view of the urinal, it will be noticed, by the way, that the fixture is in such a position that the waste is carried directly back. In this case, we might have dotted the waste to the floor, and the back air to the partition, but have preferred to show it in the way that it appears, which we believe will be clear enough for all purposes. There are many places where it is necessary to show part of the work by dotted lines, the dotted lines, of course, always signifying that the work thus shown is behind a wall or other obstruction, but the writer's opinion has always been that in this line of work, dotted lines do not add to the appearance of a drawing, and that it is better not to show them, unless the drawing will be made less clear by omitting them. Up to the present point we have confined ourselves entirely to lead and cast iron work. If we are to be able, however, to draw different kinds of work as it is presented to us, we shall need to know how to show wrought iron piping, not only on supply work, but on back airing. After what instruction has been given on cast iron work, there is not a great deal additional to be given on wrought iron. In Fig. 51, we give two methods of showing fittings, and also the two positions in which valves are usually seen. A side view of the valve shows its true shape, while in an end view the wheel handle and body represent it. In Fig. 52 is also given a sketch showing errors likely to be made, such as giving too wide a sweep to the curve of an elbow, and in making tee branches too long. A glance at the fittings themselves will show wherein the errors mentioned exist. As to a choice between the use of the beaded fittings and the plain fittings, we believe the former will be found the easiest to draw. The reason for this is that the diameter of the fittings and the diameter of the pipe are usually made the same, while the plain fittings to show as fittings, must have a greater diameter than that of the pipe, and this difference between the laying out of the two styles of fittings means less work on the beaded style.

For this reason, the writer usually pre-

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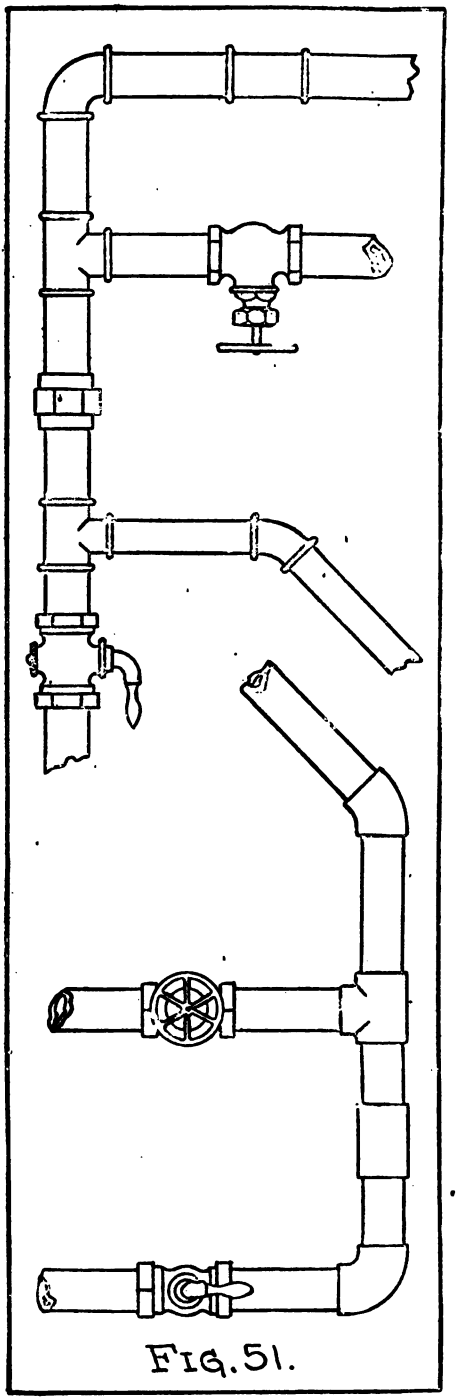

FIG. 51.

Two Methods of Drawing Fittings.

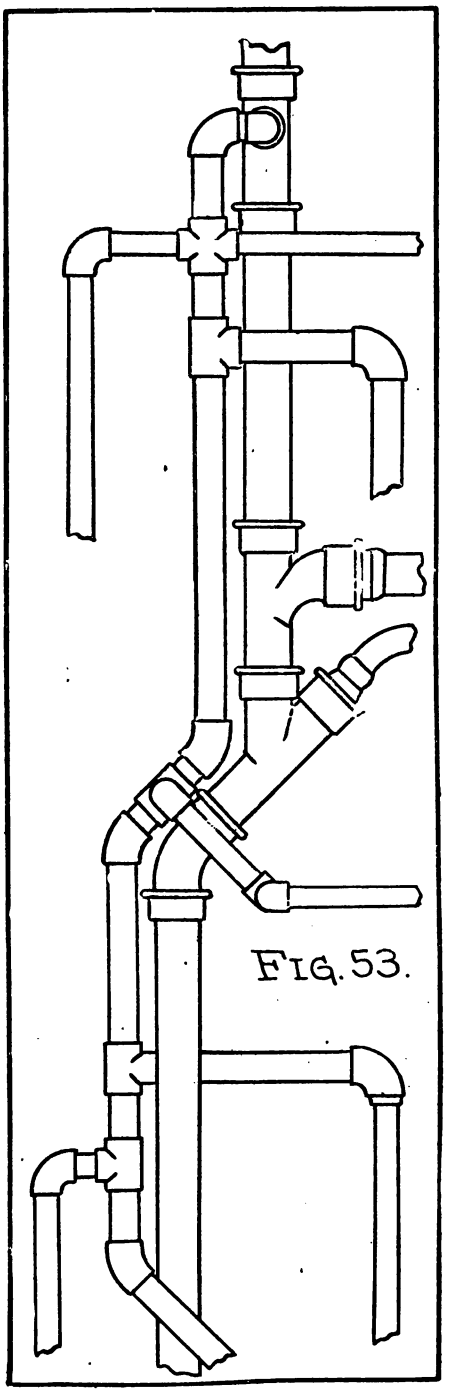

FIG. 53.

All Fittings Drawn With Ends Square.

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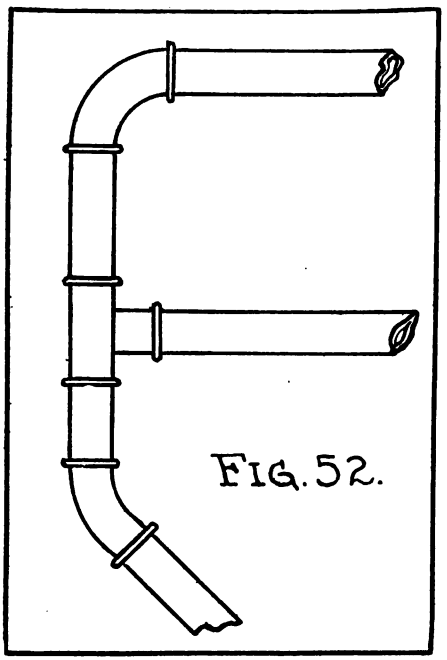
fers to use this fitting in the drawing of work in which water pipe is to be drawn,



Sketch Showing Errors Likely to be Made.

but in the case of wrought iron back air work, is inclined to use the plain fitting, as shown in Fig. 53, in which is represented back airing, including the main and the several branches. It will be noticed that fittings are shown in several different positions. For instance, the branch taken off the main back air where it offsets, comes out of the tee straight toward us, and then bends off at an angle of 45 deg., then comes out straight toward us again, and then runs horizontally. The bends used on this branch are in such a position that their true shape cannot be seen. If the beginner has difficulty at any time in seeing how different fittings appear when placed in certain positions, let him take the fittings themselves and place them before him in such positions as are required. In doing this, however, he must remember to draw whatever object he has before him, with the element of perspective entirely eliminated. We have referred to this before, but a cautionary word at this point will not be out of place. It will be noticed that all the fittings of Fig. 53, whether wrought iron or cast iron, are drawn with their ends square across, and not curved as they would usually appear in perspective. Occasionally a part of the work will have to be shown in such a way, that a certain amount of perspective will have to be used, but for one unpracticed in its execution, it is a difficult matter to make such work look well, and errors on such work are very likely to destroy the appearance of an otherwise excellent drawing. We are ready now, we believe, to take up complete elevations of different work, including both drainage and supply, and this we shall do in the next chapter.

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CHAPTER X

WHILE it must be clear to our readers that the ability to make a good, clear pencil drawing is the chief point to be gained in pursuing a task of this kind, the ability to ink the drawings is also very desirable. We presume that many of those interested will care only for the pencil work, but others on the contrary will be anxious to go further and take up inking. Inking adds character to a drawing, and makes the work much clearer than pencil can. Another point is this—if the drawing is of any extent, by the time the pencilling has been completed, even though a hard pencil has been used on the work, the sheet has become much soiled by constant rubbing over it of the hands, sleeves, the square and triangles, etc.

Now if the drawing is inked, the whole surface can be gone over with a soft sponge rubber, which will not rub off the inked lines, and the sheet made perfectly clean, or better still, a piece of transparent paper, such as thin bond paper, can be laid over the original pencil drawing and traced off onto the clean sheet. No doubt those who are pursuing this series have long before this discovered that it is almost impossible to keep the sheet clean, and ofttimes the smut has made what would otherwise be a good piece of work, look rather dubious. This is to be expected, and is more or less the experience of skilled draughtsmen. One suggestion would be, as far as possible, to complete the work at the top of the sheet first, then that next lower down, etc. This will save rubbing over finished parts of the drawing.

Another point is to see that the square and triangles are occasionally cleaned, as much of the soiling of drawings is due to dirt collected on these tools. In Fig. 54 we show illustrations of the different drawing instruments which are necessary for inking. No. 1 shows a straight line

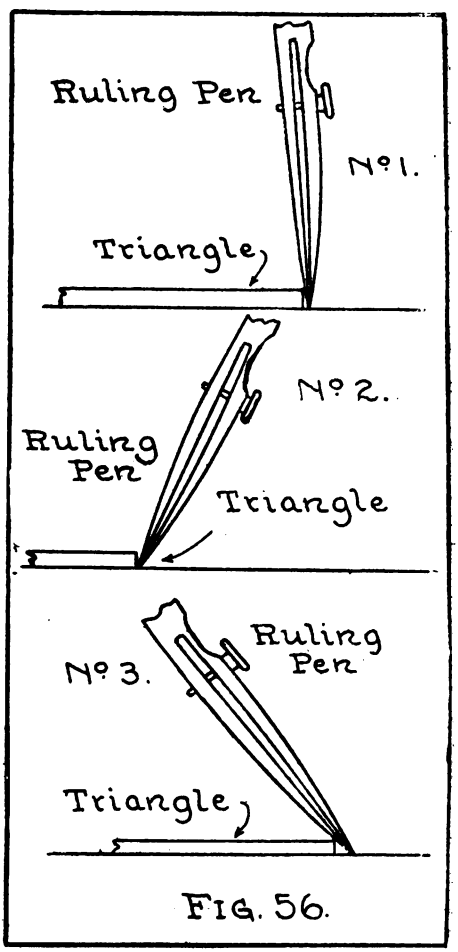

FIG. 56.

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ruling pen. It is used in drawing straight lines and is handled in the same way that a pencil is used, that is, by guiding it against the side of a triangle or tee square. No. 2 is called a bow pen, and is used in making small and medium sized circles. No. 3 is an attachment used in inking large circles. As shown, it is made with a joint and is designed to slip into the large compasses shown in our first chapter, taking the place of the pencil attachment. Each of these three instruments is usually to be found in the ordinary set of drawing instruments.

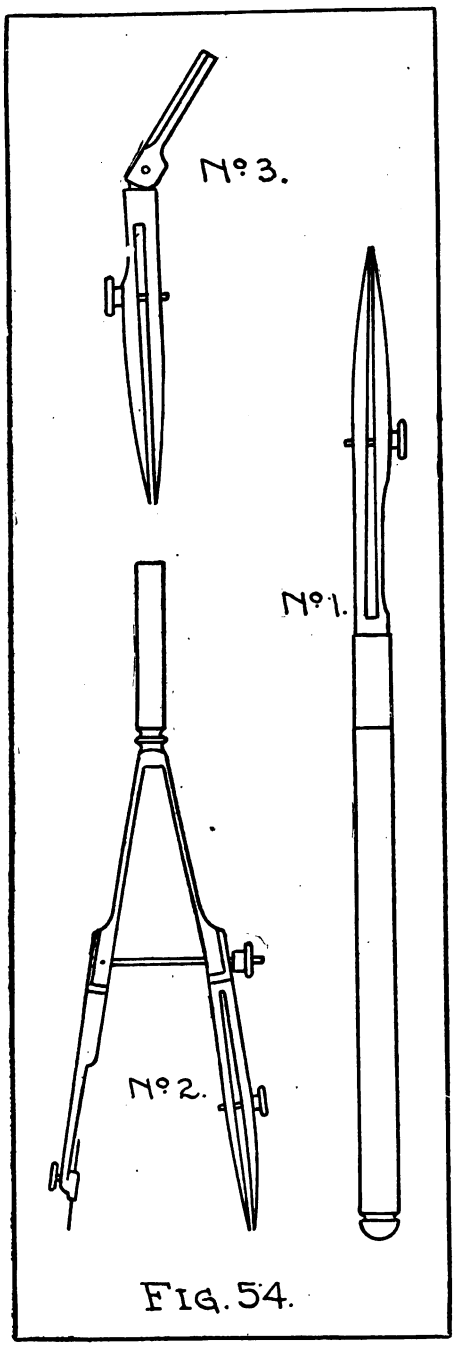

FIG. 54.

The bow pen and ruling pen are used constantly, and are absolutely necessary, while the attachment (No. 3) is made less use of. Common writing ink is not suitable for drawing purposes, an India ink being necessary. The ink usually comes in such a bottle as shown in No. 1 in Fig. 55. It will be observed that the stopper to the bottle is provided with a quill, which dips down into the ink. No. 2 in Fig. 55 will serve to illustrate the manner in which the inking instruments are filled with ink. The quill, which holds quite an amount of the ink, is touched lightly to the instrument, between the two nibs, and the ink at once flows from the quill and supplies the instrument, as the illustration shows.

It is best not to fill the instrument too full, usually not more than half as full as No. 2 indicates, for it is liable to flow too rapidly from the pen, and cause bad work. It will be readily understood that the size of the line is regulated by the little thumbscrew with which each instrument is supplied. By screwing the nibs close together a fine line is made, and a coarse one by releasing them. By the way, to those who have never had any experience in inking, a word of advice as to the making of lines will be of benefit. The beginner, nine times out of ten, endeavors to make his lines as fine as possible. This the experienced draughtsman does not do. In the first place, the instruments do not work as well on fine lines. Then again, the drawing is not so clear, and in erasing, the fine lies are more liable to be partly rubbed out. If an illustration is to be made from the drawing, a good, heavy line is preferable, and if blue prints are to be taken from the drawing, light lines are apt to appear dim on the print, especially if over-exposed. Therefore, do

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not make the mistake of getting the lines too fine.

In Fig. 56 we have endeavored to show how the ruling pen should be held in drawing straight lines. It should be held as in No. 1, nearly straight, against the edge of triangle or tee square, and bearing away from it slightly, to give clearance between the triangle and the pen. If held as in No. 2, as beginners sometimes do hold it, that is, with the angle and drawing board, the result will be that when the triangle is drawn away after the line has been made, it will draw the ink with it, and make a wide blot on the paper, as in Fig. 57. The position of the pen in No. 3 is wrong also, for when held at such an angle the ink will not flow at all, or if it does, the line will be a very poor one.

Do not bear down hard in making ink lines, for the instruments if properly ground and properly adjusted should allow the ink to flow freely enough to make good lines, under a light pressure from the hand. Very often bearing on will serve to prevent the instrument from making any line whatever, excepting the indentation into the paper, and moreover, in time it will wear the point. Drawing ink dries very quickly, camphor being used in its make-up, and if care is not taken it will dry on the end of the pen and prevent the flow of ink.

To start the ink it is a good plan to press the nib of the pen flatwise on the board, as in No. 2, Fig. 57, and unless too badly stopped, two or three attempts will usually be enough. A little moisture on the tip of the finger will also serve to start the ink. A piece of chamois skin or soft cloth should always be at hand for cleaning the ink out of the pens, and they should usually be cleaned before putting in new ink.

It is best always to clean the pens after using them, for after the ink hardens it is much more difficult. It is also necessary to see that the point of the pen does not take up pieces of lint, etc., for the tiniest piece on the end of the pen will make sorry looking work. Of course it will be understood that inking is not done on a drawing as it is being laid out. The drawing is laid out just in pencil, and then the pencil lines inked, or the work traced on transparent paper, as we have already stated.

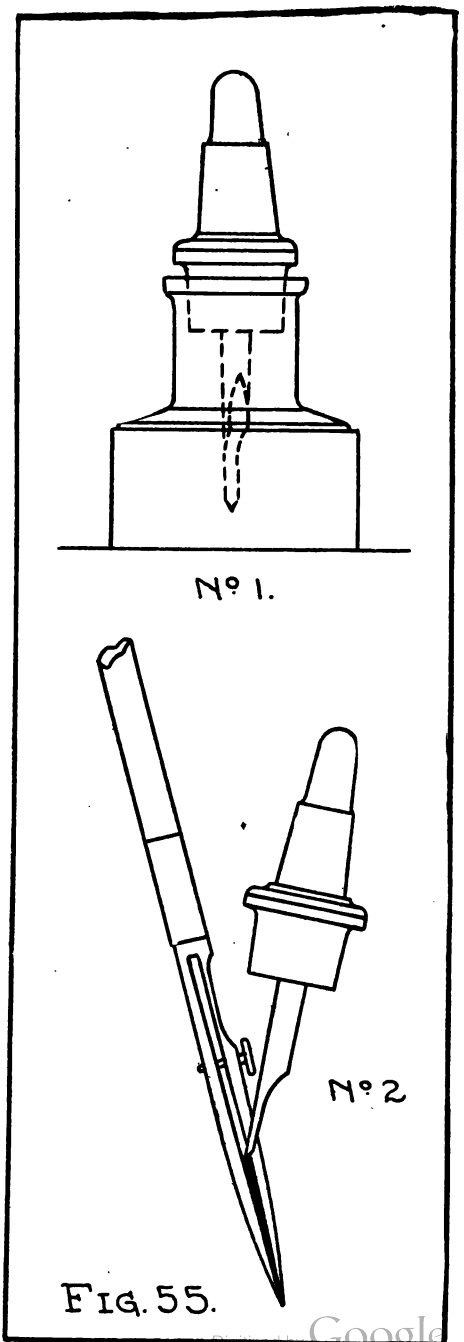

FIG. 55.

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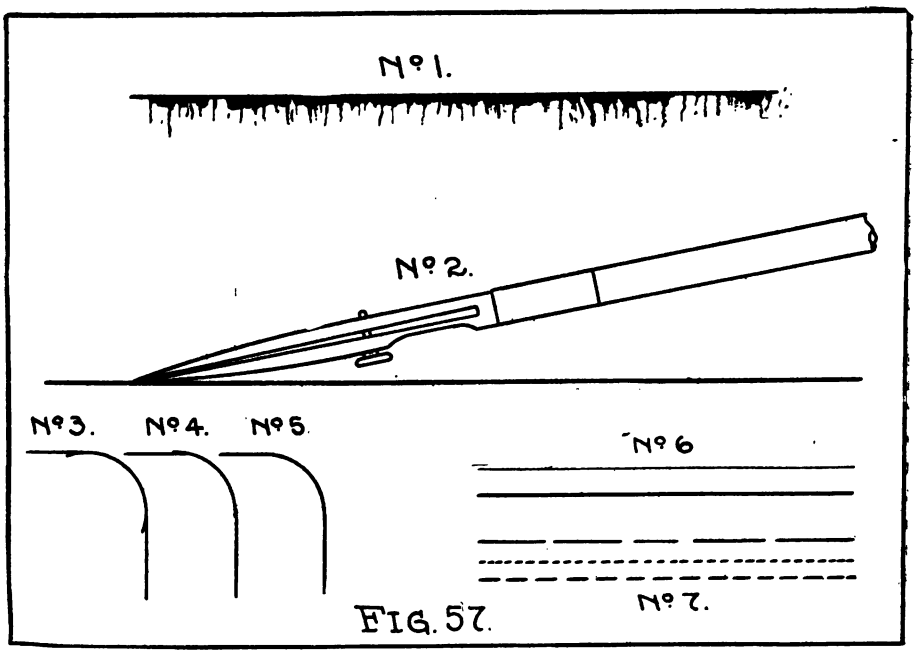

FIG. 57.

In inking a drawing, it is very essential that all the curves, both large and small, shall be inked first. It is best to go through the entire drawing, putting in every curve, rather than to ink the curves of a portion of the drawing, then lay the bow pens and put in a few straight lines, etc. After putting in the curves, with the tee square, put in all the horizontal lines, then with the triangle put in all the vertical lines, after which oblique lines are drawn. This system enables the work to be done in much less time than would be the case if it was the oblique lines are drawn. This system enables the work to be done in much less time than would be the case if it was done hit-a-miss. After all the lines are in, with a common fine pen touch up the little points, the curves that are too small to be put in with instruments, etc. In drawing the curves do not make the mistake of carrying them around beyond the point where the straight lines should join them, as in No. 3 of Fig. 57, or fail to run the two lines together smoothly, as in No. 4. No. 5 shows them run together smoothly, as they should be.

The reason, by the way, for putting in the curved lines of a drawing first, is that it is much easier to make straight lines meet a curve than to make a curve connect properly into two straight lines.

No. 6 of Fig. 57 shows two straight lines, the upper one being altogether too light and the lower one about right. In making dotted lines do not make them too coarse or too fine, as shown in the two upper lines of No. 7, but of medium length, as in the lower line.

We have not space for the regular exercises in this book, but those that are thinking of taking up inking cannot do better than practise on the inking of some of the more simple exercises which have previously been given.

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CHAPTER XI

WHILE taking up the subject of inking, it will be well to take up the shading of drawings also. This, of course, is not a necessity in the making of good drawings, at the same time it is of much value. A knowledge of the subject should be possessed by one who takes up drawing, and having it in his possession, he can use it or not, according as he deems best.

Shading is used to set off a drawing, and to make it clearer than can be done with the plain work such as we have used up to this point. It gives character to the drawing, and makes it more attractive. From the manner in which the shading appears, it can be told at once whether a certain part of the drawing represents a projection or a hole in the object illustrated. Thus in Fig. 58, the shading of No. 1 shows that it is a solid piece, a rectangular block for instance. Now, referring to No. 3 of the same sketch, Q, R, S, T represents a rectangular figure of the same size and shape as No. 1, but shaded in a different manner. This shading shows us at once that Q, R, S, T is a rectangular hole cut in the block M, N, O, P, the latter being of course shaded in the same manner as No. 1.

Exactly in the same way, No. 2, shows by its shading a tee-shaped figure, and No. 4, by its different shading, shows a hole cut in the shape of a tee in the block U, V, W, X.

Also, in Fig. 59, No. 2 shows the end of a solid cylinder, and No. 3, by the difference from No. 2 in shading represents a cylindrical hole bored into the end of the block R, S, T, U.

Light and shade is naturally dependent upon the manner in which the rays of

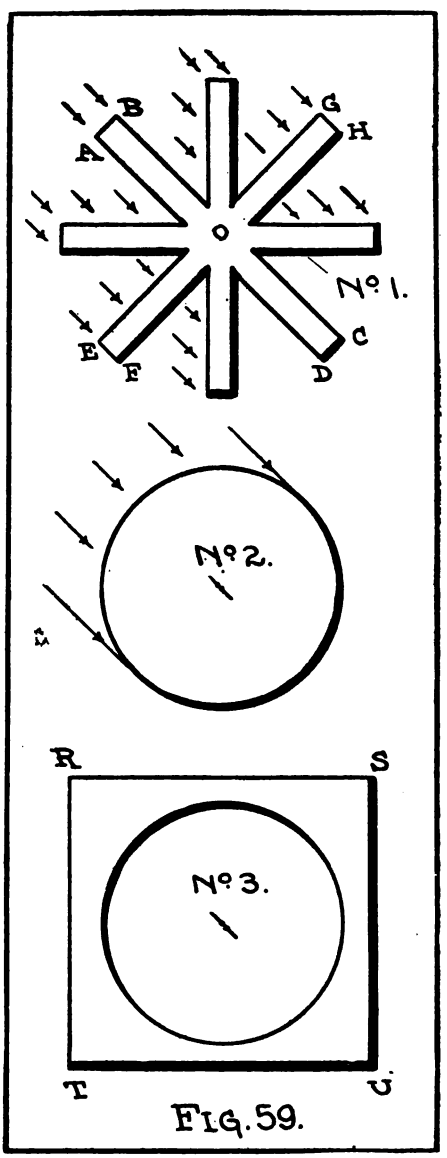

Fig. 59.

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light fall upon an object, and in order to make the shading of drawings consistent and systematic, the rays of light must always be considered as coming from a given direction, and after determining upon the direction in which they are to come, it should not be changed.

On this work, light may be assumed to come from the upper left hand corner of the drawing board, parallel with the surface of the board, and at an angle of 45 degrees with the horizontal and vertical lines of the drawing.

These rays of light are represented by the arrowheads of Nos. 1 and 2 in Figs. 58 and 59.

Any surface which these 45-degree lines strike is a light surface, and one which they do not strike is a dark surface. The line of intersection of two light surfaces is a light line, and not shaded, but the line of intersection of a light and a dark surface, or of two dark surfaces should be shaded.

Lines in the drawing which are drawn at 45 degrees and parallel with the rays of light are never shaded. Referring again to No. 1, of Fig. 58, it will be seen that light strikes the lines A B and A C, which are therefore light lines, but because the object itself presents an obstacle to the further passage of light, the lines B D and C D are dark, and therefore shaded. In the same way we can account for the light and heavy lines in No. 2. In No. 2 it will be observed that the arrowhead passing through the corner G would strike the line H K at Y. It will be asked why H K is not shaded above Y, as the lines of light do not strike it. According to what we have said on the subject, this should follow, but it will be seen that a line partly heavy and partly light would not look well, and, therefore, for the sake of preserving the system, a line of this kind and in such location is made light.

Another contradiction arises of a similar nature, in connection with Nos. 3 and 4.

It would rightly be argued that owing to the wall or shell surrounding the hole, no light would strike the lines representing the rectangular hole, and therefore all four of those lines should be dark. This would not only break up the uniformity of this system of shading, but such a course would fail to make the contrast that sets out the figure as does the

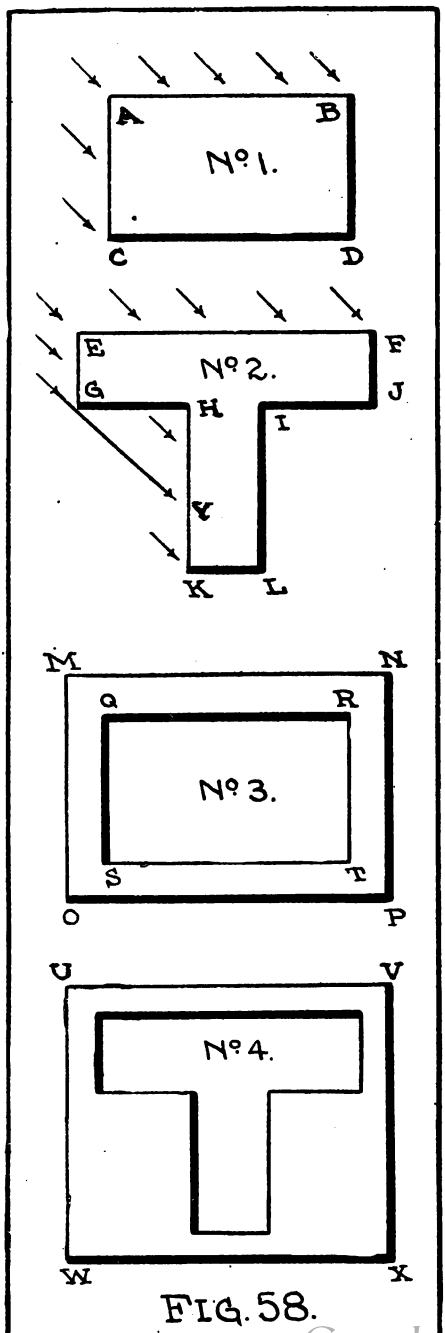

FIG. 58.

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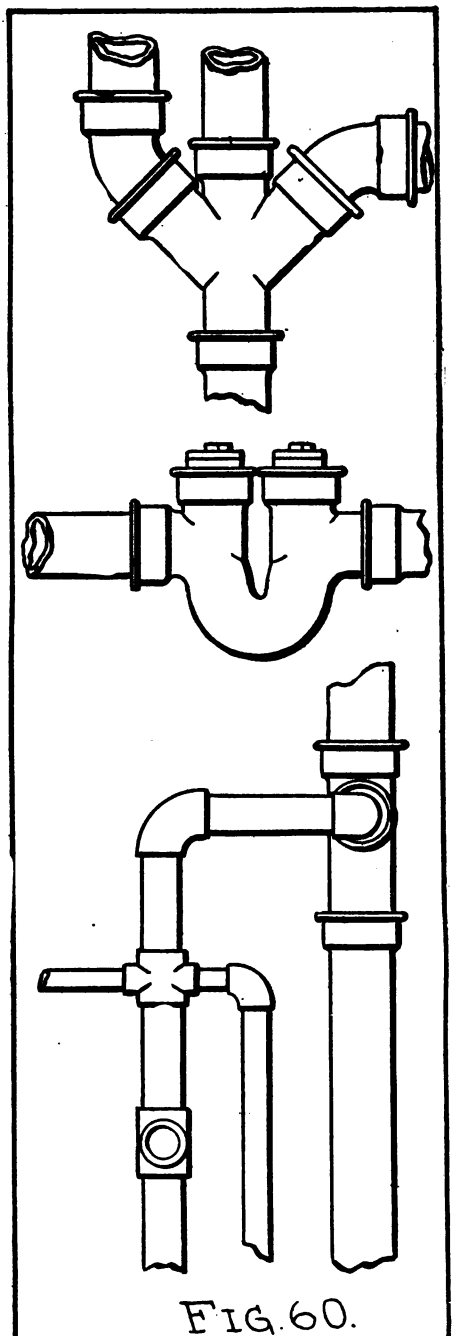

FIG. 60.

method followed in Nos. 3 and 4. Comparing Nos. 1 and 3, it will be seen that lines shaded in the one are light in the other, also in the case of Nos. 3 and 4. In No. 1 of Fig. 59, the same difficulties or apparent contradictions arise that we have already mentioned. In such a case as this, in order to preserve the uniformity of the system, each branch must be considered entirely by itself, and then there will be no trouble.

In this figure, the lines A O, B O, C O, and D O, also the four lines, E O, F O, G O and H O are drawn at 45 degrees. The first four are drawn parallel to the direction of the rays of light, and are therefore not shaded, but in the case of the latter four, although drawn at 45 degrees, they are not parallel to the rays of light, and should therefore be treated as any other lines would.

In the case of the shading of circles, the reasoning is no different from that followed in the shading of straight lines. Those rays that strike the circle on a tangent determine the points at which the shading should begin. In shading a circle, draw in the light circle first, then with the same radius take a new center at an angle of 45 degrees from the first center, the distance between the two centers determining the width of the shade line at its widest point.

In No. 2, the second center is taken above, and in No. 3 below the first center. In putting in the second circle, use the same size of line as in the first, and fill in the space between them. In Fig. 60 we give exercises in shading, which will serve to show how the principles which we have discussed above, are applied on the shading of plumbing drawings.

In putting in the shade lines, they are usually drawn heavy at the outset, but it may possibly be easier for beginners to ink their drawings in the usual way, and then go over the lines to be shaded afterward, making them several times heavier than the light lines. If those who do not take up the inking care to do so they may shade their pencil drawings by using on the heavy lines a very soft pencil.

In inking shaded drawings it is customary to put in the light horizontal lines first, then the heavy lines, and so with the vertical lines. This method will save the trouble of changing the adjustment on the pen so frequently, and will result in more even work.

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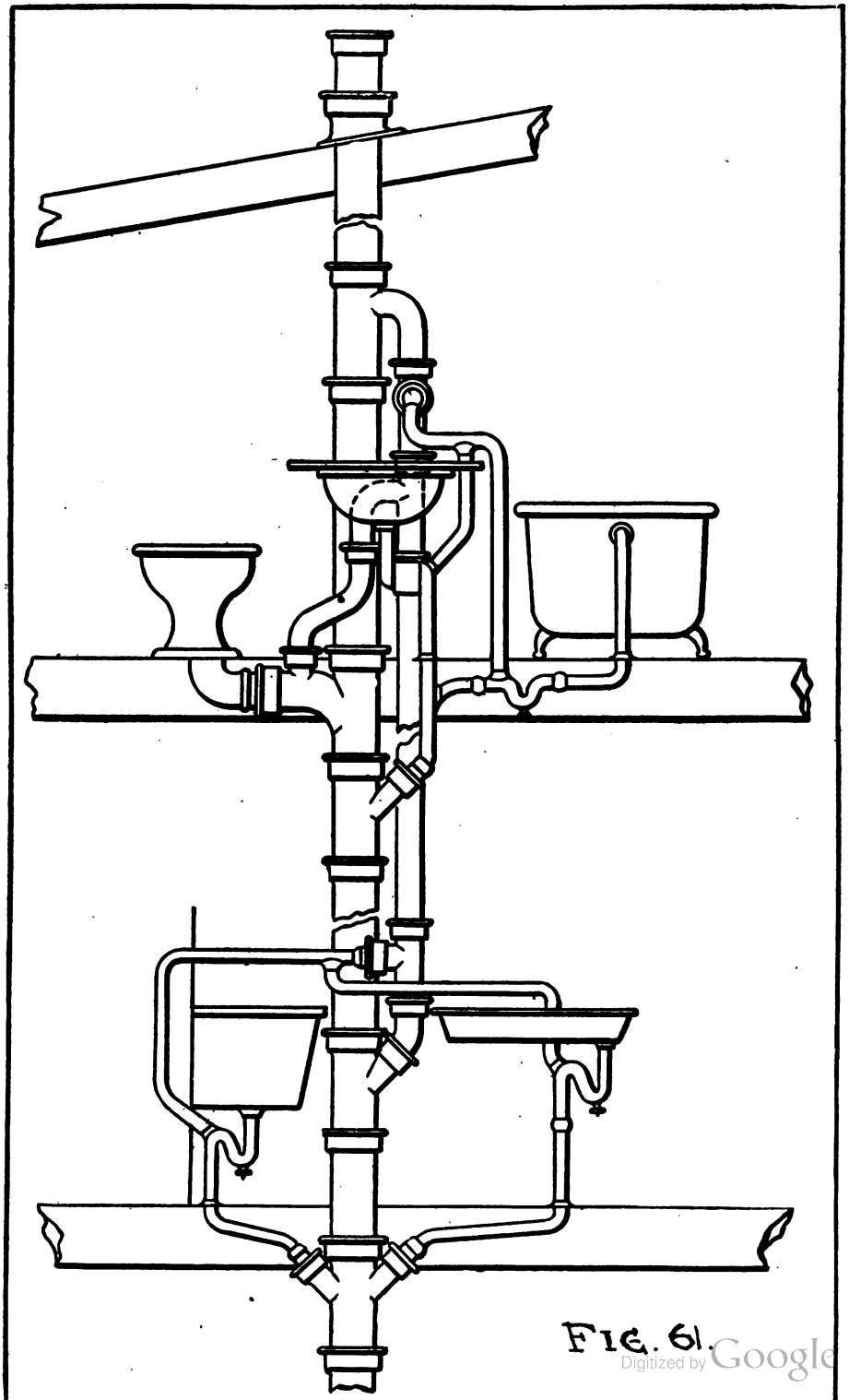

FIG. 61.

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It will be found that very often a drawing will look better if the finer work, such as the supply pipes, etc., are not shaded, only the fixtures and larger connections being thus treated.

In Fig. 61 we give the elevation of the plumbing system for a cottage house, the work being shaded. This is the first complete elevation that we have given as an elevation, but we believe that those who have followed foregoing instructions will have no difficulty in making this drawing.

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CHAPTER XII

THE method of shading which we gave in the preceding chapter is easy to handle, and it certainly is of value in making the drawing very clear and distinct. There is also another method of shading, which, however, is much more difficult of execution.

This style of shading we show in Figs. 62, 63 and 64, and in order to be able to use it to good effect, considerable experience and practice is necessary. It is used more for ornamental purposes than for practical purposes, but still, no book on drawing would be complete without some attention to it. It is seldom or never that a drawing of any extent would be shaded throughout in this manner, but our readers will find, if they do much in the way of drawing, that its use will often be a valuable aid in showing up apparatus of different kinds, portions of plain drawings that are desired to be brought out with great clearness, etc.

In the use of this shading, there are exact rules that are laid down as to the point which should be shaded heaviest, as well as lightest. It will be sufficient, however, for our purposes to make this instruction very brief and to the point.

The results seen in Nos. 1 and 2, of Fig. 62, are obtained by giving the greatest shade effect to the right hand side of the figure, the lightest point being about midway, and the left hand side being shaded somewhat, though not so heavily as the right hand side. These two figures represent solid cylindrical figures. No. 3, a hollow cylindrical figure is shaded in exactly an opposite manner, that is, with the heaviest shading at the left, medium shade effect at the right, but with the lightest point still near the center. No. 4, a horizontal solid cylinder, is shaded

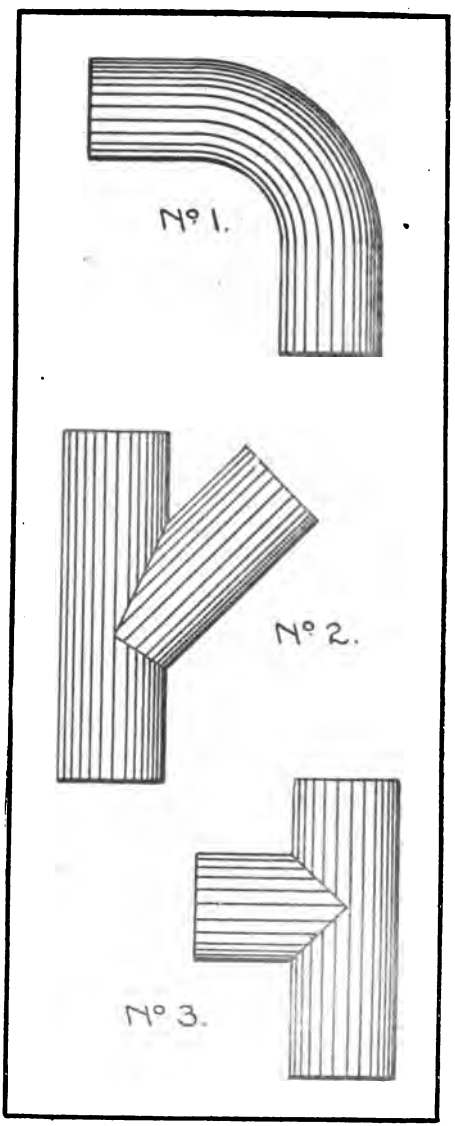

FIG. 63.

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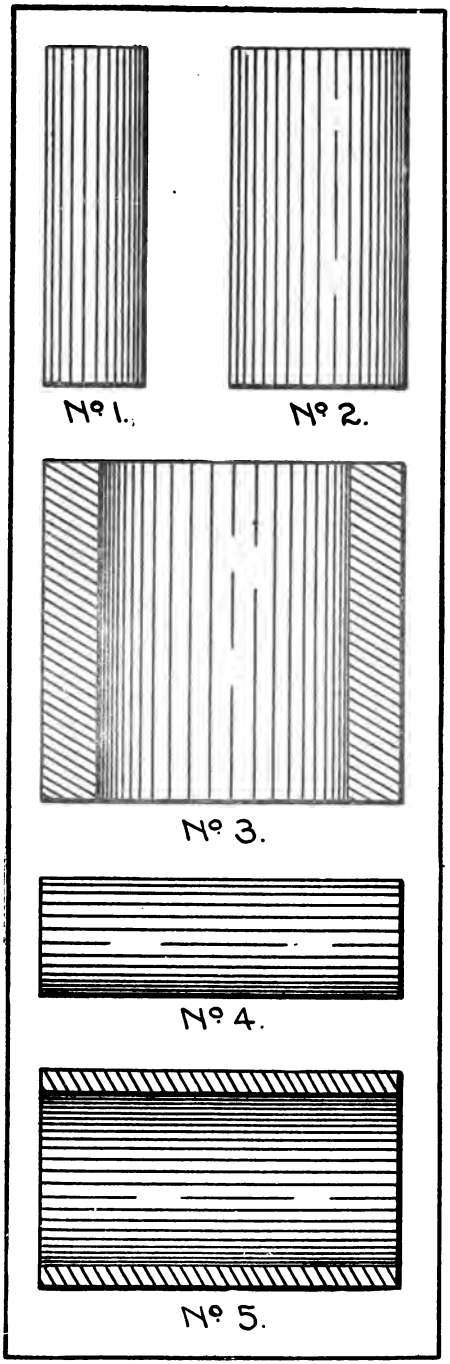

FIG. 62.

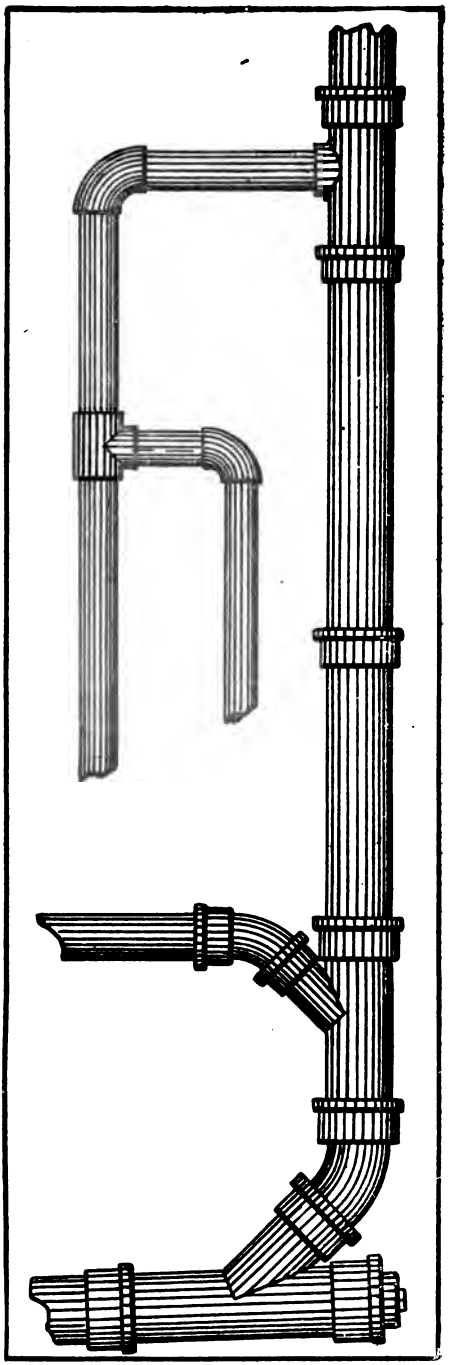

FIG. 64.

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CHAPTER XII

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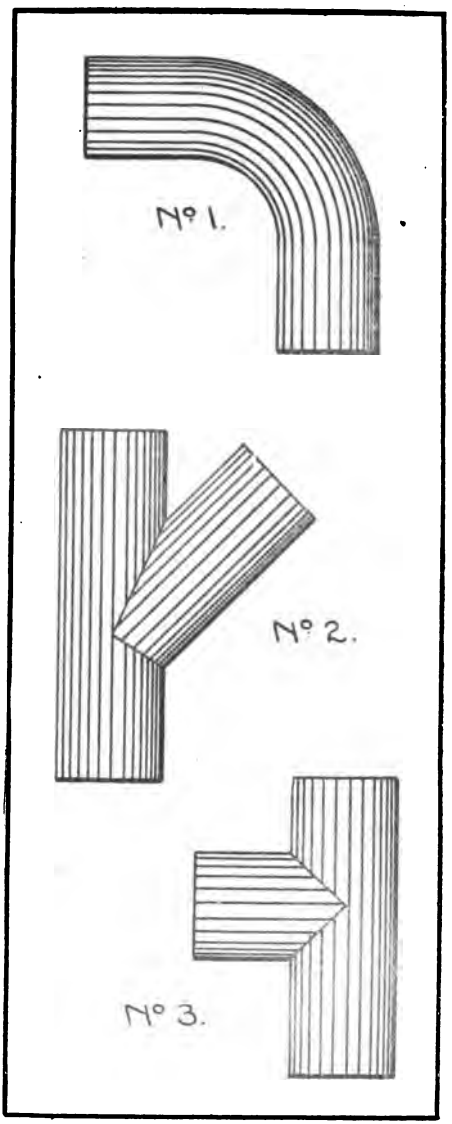

FIG. 63.

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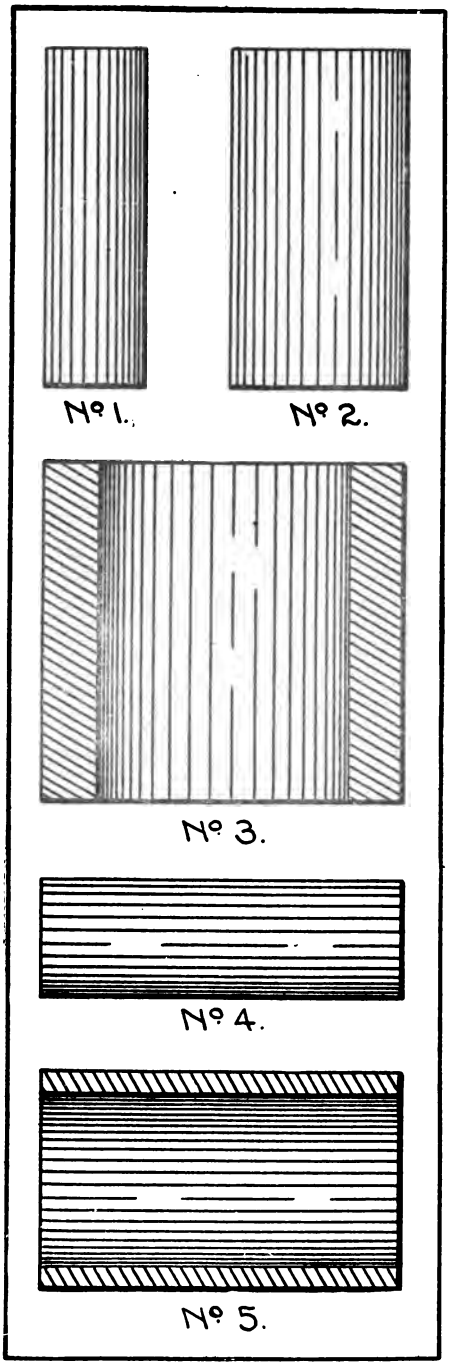

FIG. 62.

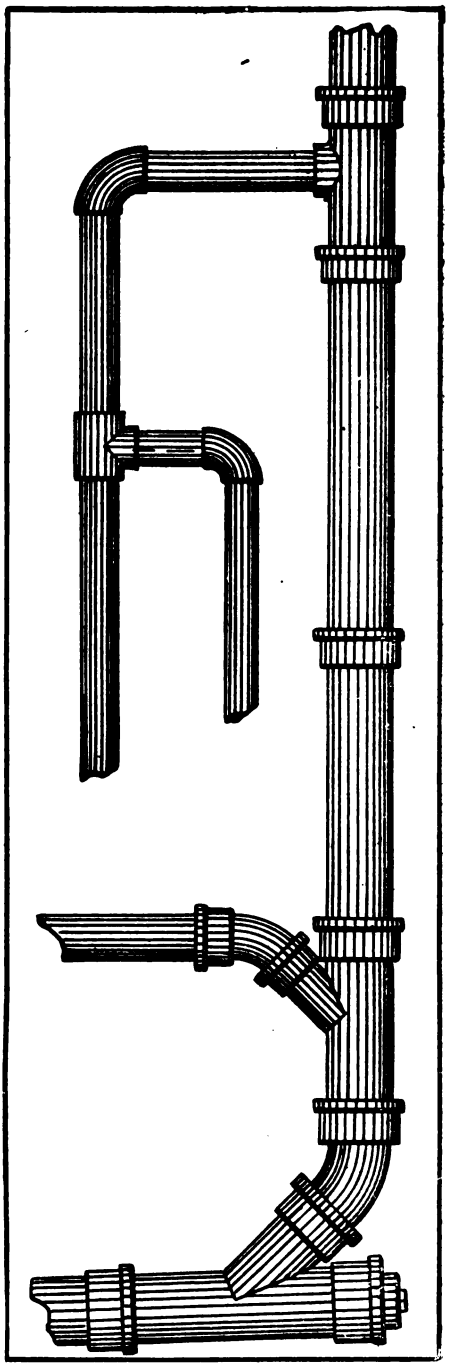

FIG. 64.

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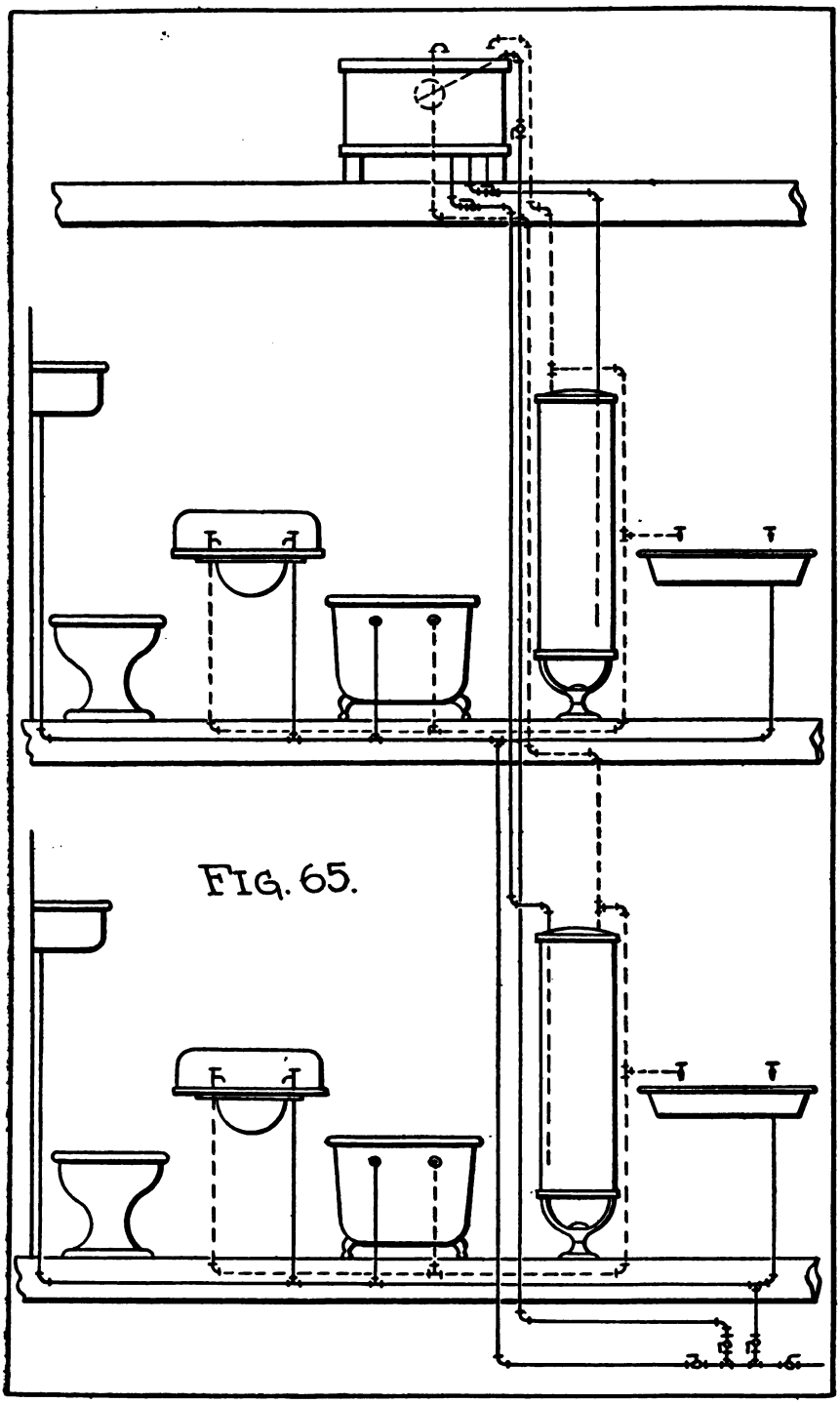

Sketch of Elevation of Hot and Cold Water Supply System For a Two-Flat House.

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heavy at the bottom, and medium at the top, while No. 5, a horizontal hollow cylinder is shaded in an opposite manner, as will readily be seen. Additional effect is gained by using the heavy shade lines as described in the preceding article.

In drawing these shade lines, the effect of shade is gained entirely by the closeness of the lines together, the heavy shading being produced by drawing the lines closely together and the light shading by giving considerable space between the lines, additional effect being given by breaking the lines as appears on most of the figures. The skill in doing this work comes from the ability to vary the spaces between the lines in such a manner that the figure will appear cylindrical at all points, and nowhere flat, as it would if the spacing was not varied continually.

The greater the diameter of the cylindrical figure, the greater should be the space between lines at the lightest point. The proper spacing of these lines is gained only from practice, it being a thing that cannot be reached from any exact instructions, or from measurement.

To those who are not interested in the inking of drawings, we would say that this shading can be done also with lead pencil. In Fig. 63, No. 1 shows an elbow shaded. The curved lines are all struck from the one center, and should be put in first, and the straight lines connected with them afterward. In shading branches, as Nos. 2 ard 3, the lines of intersection should be drawn in first, and the shade lines of the branch should end at those lines.

Fig. 64 shows the principle of line shading applied to a system of piping.

As we have already intimated, this work is more ornamental than otherwise, and a knowledge of its use will often be found handy. As our regular practice exercise, we give this time, Fig. 65, an elevation of the hot and cold water supply system for a two-flat house, and have shown the lines of pipe as single lines, the cold pipes being represented by solid lines, and the hot by dotted lines. This method is often preferable to using two parallel lines to show the pipe, as it is simpler to draw, takes less time, and often shows off the work fully as clearly. It will be understood that our illustrations being designed for reproduction as cuts in a paper, have to be drawn in black ink. Under ordinary conditions, different colored inks could be used to advantage, however. For instance, instead of dotting the hot water pipes, as we have to in this case to make our distinction from the cold water, the hot water pipe might be put in with solid red lines, with good effect. If desirable, a back air system might be put in with one color, while a different color was used on the drainage part of the work.

Sometimes, also, it is required to make a drawing in which part of the work is old work, and the rest new work. In this case, one color to show the old and another to show the new, makes good work, and is more readily distinguished.

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CHAPTER XIII

WE have said nothing so far concerning sectional drawings, but as they constitute a valuable aid in the clear representation of many kinds of work, it will be worth our while to devote some space to their consideration. From a comparison of Nos. 1 and 2 in Fig. 66, we shall be able to see wherein the value of sectional drawings lies.

No. 1 represents a Fuller bibb, and the dotted lines represent the inside working parts.

No. 2 represents the same thing, but instead of drawing a plain view as in No. 1, the bibb is considered to be cut through along the center line, and the front half set aside. This allows a full view of the other half. A sectional view of the bibb is a view of this half section such as No. 2 gives, and it will be seen at once that the sectional view is far clearer than that shown by No. 1. To show that it is a sectional drawing, the part that is cut through is always sectioned or cross-hatched. By this is meant the parallel lines drawn close together, which designate the body of the bibb. These lines may be drawn with either the 45 deg. or 30 deg. triangle. Every point of any given piece should be sectioned in the same way. For instance, the inlet end of the bibb, which screws onto the body, is represented in the drawing by a section of metal above the center, and one below, both of which, being a part of the same piece, should be sectioned by lines drawn in the same direction and at the same angle. It is often the case that these sections are represented by different colors instead of section lines, the different colors representing different pieces of the article in question.

When section lines are used, and the different sectioned parts are in contact with each other, the sections of neighboring pieces must be made by reversing the triangle, and drawing the lines at opposite angles, just as No. 2 shows. It will be observed that in drawing the sec-

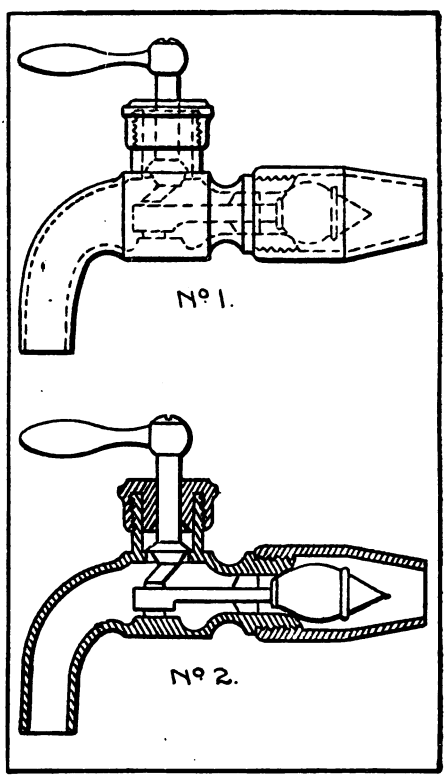

FIG. 66.

tion the working parts have been drawn plain, and not in section. The idea is always to make any drawing show the object it is made to represent with the greatest possible amount of clearness, and it will be found in this case that the bibb is shown much more clearly by leaving the working parts plain, instead of sec-

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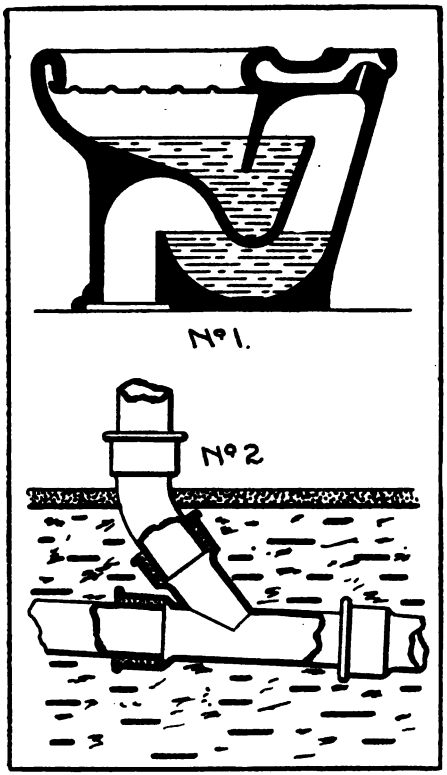

FIG. 67.

tioning them in the manner that the rest of the bibb is seen.

No. 1 of Fig. 67 represents a sectional view of a certain type of water closet. In this case the whole section is of one piece only, and in such a case, a solid black section looks well. This could not be sectioned in this manner if there were several parts to be sectioned for in using a solid color, there would be no way of making a distinction between the several parts. In plumbing drawings it is often required to represent water, and we know of no better way than that shown in connection with the water closet, that is by horizontal light lines, made up of alternate dots and dashes. It will be observed that in a sectional view of the water closet, the flushing rim would be cut through at either end, but the main part of the rim, curving backward as it does, away from the line of sectioning, would be drawn in full, in the manner in which we show it. No. 2 represents a line of soil pipe underground. A full black section looks well on such work, better in fact than the section lines, which are really used mostly on larger surfaces. To distinguish the lead joints from the pipe, they are made with small dots. The concrete floor may be made as we have indicated, and the ground surrounding the pipe in an indefinite manner, by having short lines made with the drawing pen, and interspersed with lines made with a common pen.

In Fig. 68 we have represented part of the base of a water closet, connected by brass flange of a certain style, with the lead bend; the fixture being vented from the bend. This we give to show the section of several different materials brought together on the same drawing.

It is a common thing with draughtsmen, to use certain different styles of section for different metals, especially in the drawings of machines, but for our use this is unnecessary, the main point being the use of such styles of sectioning as will clearly distinguish the different parts of the same drawing, one from the other. Thus in Fig. 68 the crockery is shown in section by dot and dash lines, the rubber gaskit by a fine dotted surface, the brass flange by 45 deg. section lines, the solder sections by 45 deg. lines drawn in the opposite directions, the lead by solid black surface, and the wood by lines representing the grain of wood. It will be noticed that the back air pipe is in sections only a short distance up, after

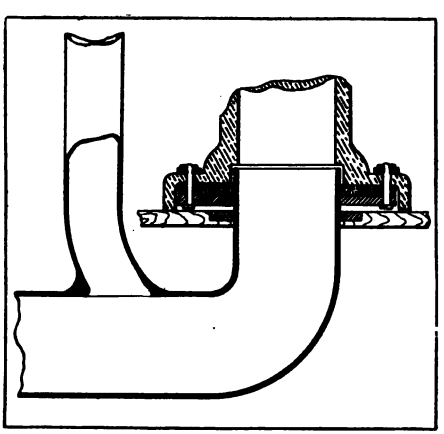

FIG. 68.

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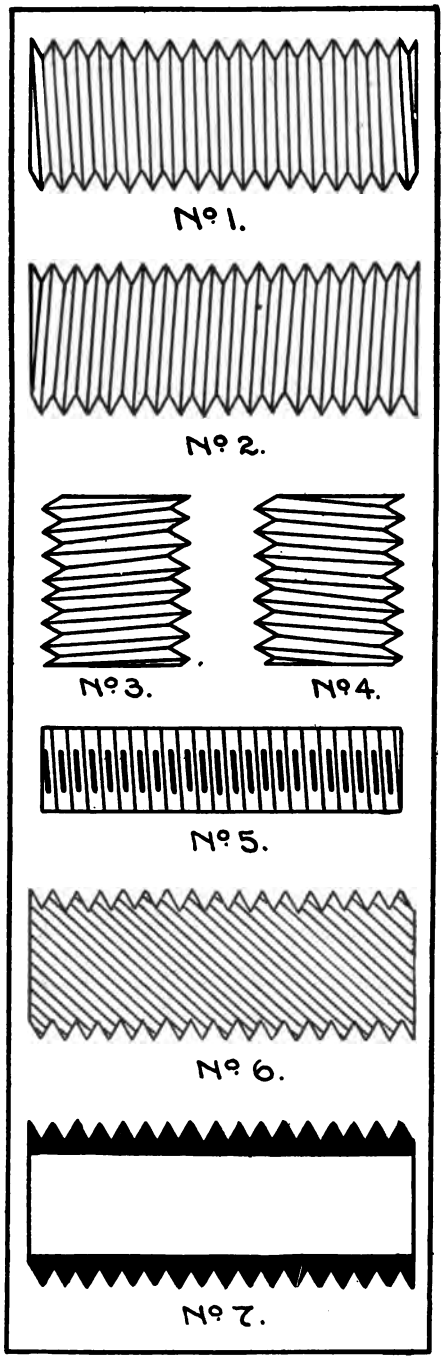

Fig. 69.

which it is drawn in the usual way. This is often the case, and a division between the sectioned and unsectioned parts is made by an irregular section, as shown.

Another point which will be of value to the plumber in making drawings of different fixtures, fittings, etc., is the making of threads. This we show in Fig. 69. No. 1 represents a right-hand V thread. The tool that is used in cutting this kind of thread is sharpened or ground on its cutting point at an angle of 60 deg. Consequently, in drawing the threads they are made at this same angle. If it is desired to do this work with exactness, the number of threads to the inch is first found, eight being the number used in our illustration.

The upper line is then laid off into one-eighth inch spaces and the lower line also, the latter, however, being spaced one-half space or one-sixteenth in this case, in advance of the upper spaces. This is to give a pitch to the thread, for otherwise the thread would be straight up and down.

Having laid out the spaces, put in the Vs, using for this purpose the 30 deg. triangle.

All the lines sloping in one direction and first put in, and then the triangle is reversed and the lines pointing the opposite way drawn in.

The outside and inside points are then connected by straight lines. No. 2 shows a left-hand thread. The layout for both is the same, the distinction between right and left hand threads being gained by properly connecting the long cross lines.

Nos. 3 and 4 show the two kinds of thread drawn in a vertical position, and No. 5 shows a method often used for indicating a thread, where it is not desired to use so much time as is necessary in laying out a regular thread.

No. 6 shows a sectional view of a threaded piece, and No. 7 a sectional view of a hollow piece threaded on the outside. Naturally, in a sectional view, the lines connecting the top and bottom of the threads are not seen, the V only being shown.

Owing to lack of space, we omit the regular exercise for this article, and would advise in its place, practice on sections and threads.

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CHAPTER XIV

AFTER having in the last few articles diverged somewhat from the line that we had been following, we will in this article take up again the consideration of complete elevations of plumbing work. In Fig. 70 we gives the floor plan of a three-flat apartment house. As each of the three floors are identical in their layout, the one floor plan is all that is required the work with as great clearness as is to be desired.

For instance, if a side view of the entire system were to be made, that is, a view taken by looking in the direction in which the arrow A points, the bath-room work would show plainly, in fact to its best advantage, but the pantry sink coming in front of the range boiler would tend to complicate and confuse the drawing of

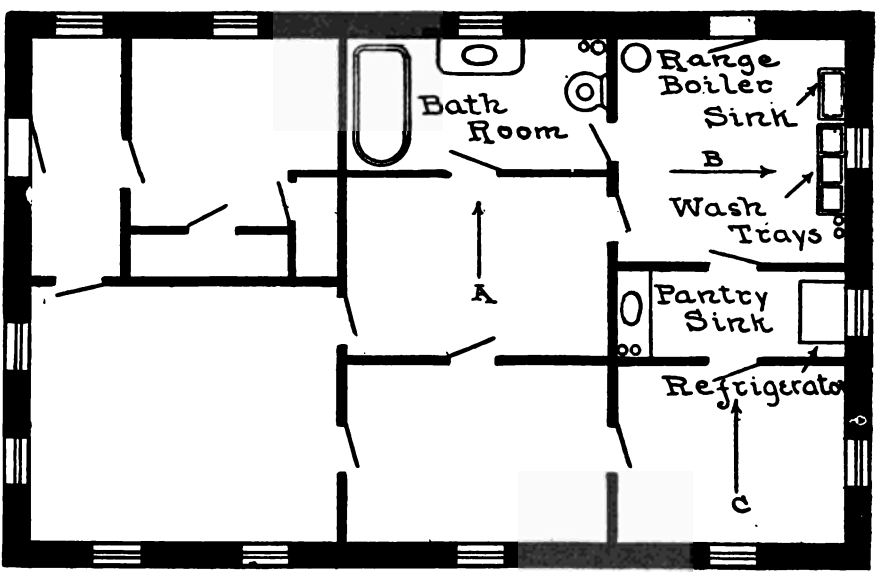

FIG. 70.

in this line, as it answers for all. In addition Fig. 71 shows the cellar plan for the same work, the drainage pipes only being shown, however, as in this work we have no use for other details.

A careful study of the floor plan will show that the arrangement of the plumbing is such that no one view of the whole plumbing system will show all parts of each of the two fixtures, and the same thing would be true of the kitchen fixtures. At this latter point the kitchen sink, wash trays and refrigerator would each stand in line with the other, if viewed in the direction of the arrows, A and C, and the drawing resulting from such a view would be so confused, owing to the many lines, that it could hardly

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be understood, even from careful study. In fact, the refrigerator would hide the other fixtures from view, and if shown at all, the sink and wash trays with their connections would have to be shown by dotted lines. Then again, the main lines of waste and back air serving the kitchen fixtures would also come in line with each other, and this as we already know, does not make the drawing any clearer. Consequently, conditions being as they are, it is advisable to make separate elevations of the different parts of the work.

An elevation of the kitchen work can be shown to best advantage by taking a front elevation of it, that is, by viewing the work from the direction in which the arrow B points.

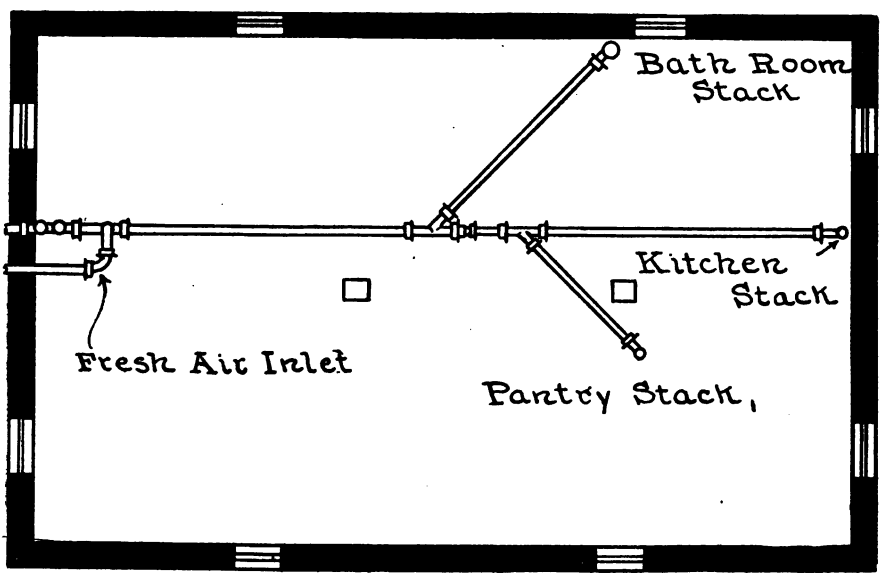

FIG. 71.

The refrigerator line can also be included in this elevation, which we show in Fig. 72.

It will be seen that we have not shown the fixtures and connections of the kitchen work on the second floor. Nothing is to be gained by showing this part of the elevation, as it is identical with the work on the third floor, and it is omitted for the sake of economizing space. For this same reason we have not shown the full line of waste to the point where it enters the horizontal line on the cellar bottom. The only additional point that the view of the remainder of the waste would show is the connection of the vertical and horizontal lines through Y branch and bend, with cleanout. The line of pantry sinks is shown in elevation in Fig. 73, and this view is taken from a direction exactly opposite to the direction of the arrow B. A side view might have been taken of this part of the work, our reason for choosing the one shown, being to bring out a point concerning the main lines of vent and waste. In Fig. 73 they are one behind the other, the vent being in front. Being of the same diameter, one hides the other, so that wherever the vent line runs, only a part of the hubs on the waste can show. If it had not been for bringing out this point we should have chosen a side view of this work. Just as in Fig. 72, we have omitted the second floor work.

Sometimes it is advisable to show in connection with an elevation, the horizontal line in the cellar. On these two elevations we have omitted it, however, and for two reasons.

In the first place, this additional work would make our illustrations take up more space than we wish to devote to them, and then again, by reference to the

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cellar plan, a perfectly clear idea can be gained of this part of the work, which would make its appearance on the elevation somewhat superfluous.

In the following chapter we shall show an elevation of work in the bath room.

The four illustrations in this chapter will make good practice work, but it will probably be advisable to draw them on a larger scale, perhaps double size.

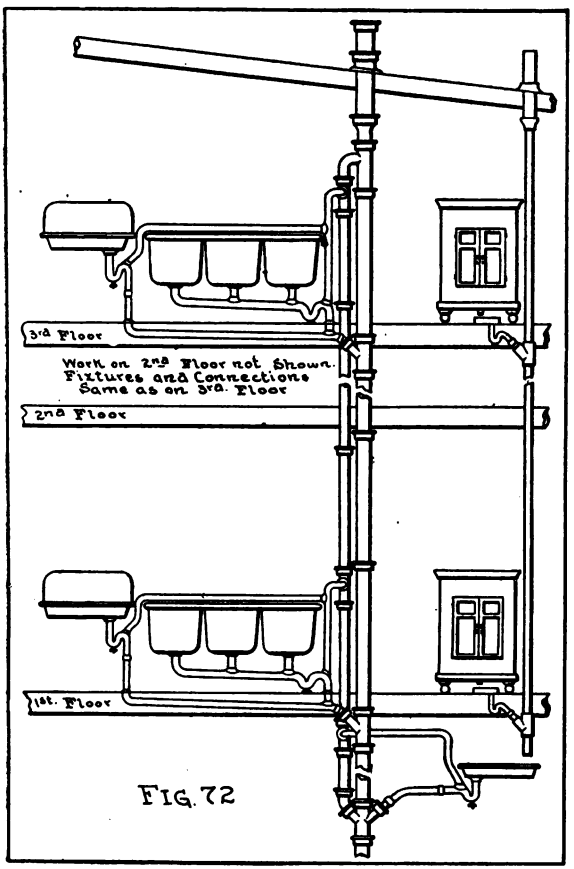

FIG. 72

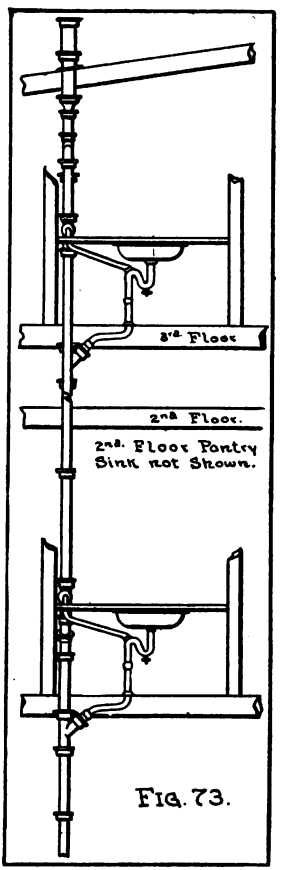

FIG. 73.

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CHAPTER XV

IN the preceding chapter we showed elevations of the work of a three-flat apartment building, including the kitchen fixtures, pantry sinks and refrigerators. Owing to lack of space we omitted the elevation of the bath room work, and this we now show in Fig. 74.

In showing an elevation of the three-flat apartment work, we brought out the point that it often occurs that a complete elevation of the plumbing work of any extent cannot be shown to the best advantage by taking a view of all parts of the work from one direction, and that it is often best, and indeed almost necessary to a clear understanding of the drawing, to make separate views of different sections of the work, viewing each section from the most advantageous position.

To clearly demonstrate this point, we show in Fig. 75 a floor plan of the same work that we showed in connection with the work of the preceding article, the layout of the floor plan being identical, and the only difference being a change in the location of the sink and laundry tubs to another side of the kitchen. Now then, in Fig. 76 we give an elevation of the entire plumbing work of the apartment

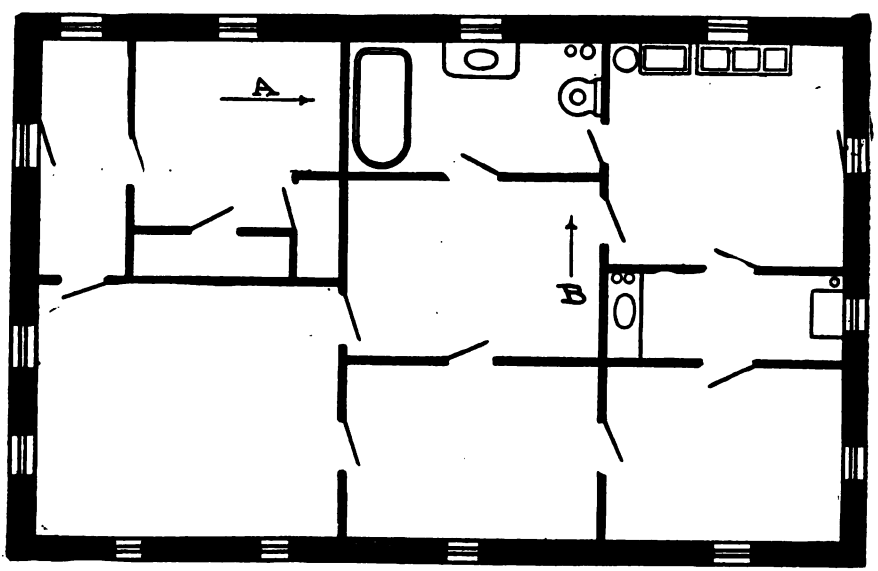

FIG. 75.

shown in Fig. 75. It will be observed that in order to obtain this elevation the work must be viewed looking in the direction in which the arrow B points. In this particular layout of the work the entire elevation is clearly shown from one view, and it does not become necessary to make separate elevations of the different lines of fixtures viewed from different directions. It is somewhat unusual

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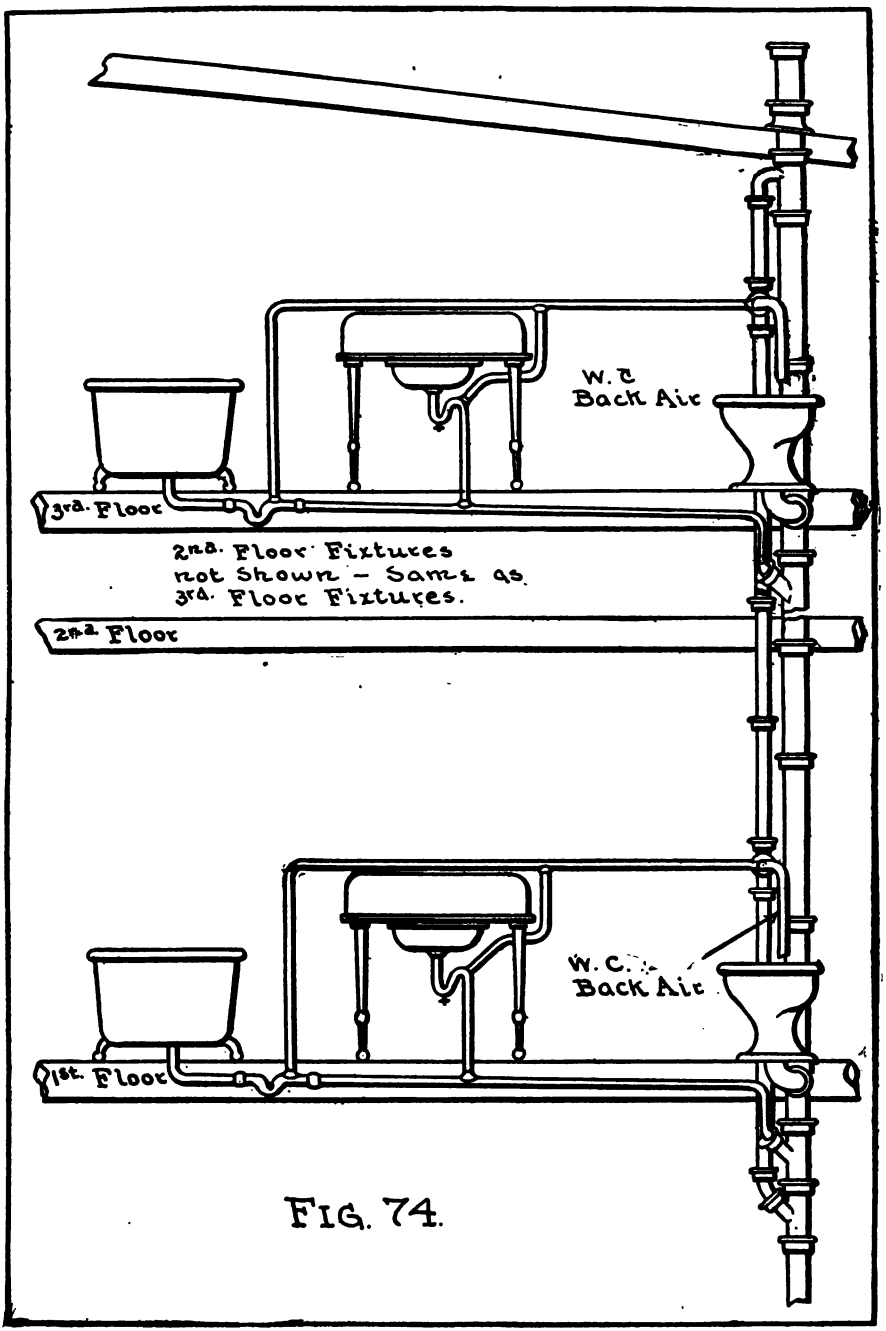

FIG. 74.

to find a layout that can be handled in this way, of work of such extent, but whenever possible, this course should be followed. A glance at Fig. 75 will show that while the bath room and kitchen fixtures are on a line with each other, or very nearly so, the pantry sink and refrigerator are off at one side, but at the same time are so located as to show to advantage in the elevation. However,

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there is nothing in the elevation to show that the refrigerator occupies a position in front of the bath room and kitchen fixtures, and nothing to show this point in relation to the pantry sink excepting the fact that the waste and vent stacks serving the pantry sink cross the pipes of the other fixtures in front of them. Furthermore, even this latter fact is of little importance, for it does not show how far in front the pantry sink is. To ascertain this fact, and the location of the refrigerator, we must look to a plan of the work, that is, to Fig. 75. This goes to show that from no single view can all the facts relating to the work be found, and this is true of the most simple object we can think of. For instance, we can place a board directly in front of us, and at once observe its length and its width, but in order to know its thickness, we must look down upon its edge, in order to get at its thickness. This is a most important fact to understand thoroughly, and a proper understanding of this feature of the work will go a long way to aid in understanding just how important to each other the plan and the elevation are, and why one is as necessary as the other.

Thus far we have been speaking of the elevation shown in Fig. 76, which is taken looking in the direction of arrow B. Now suppose we had viewed the work from the direction of arrow A. We should get the result shown in Fig. 77, which to say the least is very unsatisfactory to a clear understanding of the work. Looking in the direction of A, the fixtures in the bath room, and in the kitchen are one behind the other, and as they must be shown in this way on the elevation, the result is very confusing and of little value as compared with the elevation of the same work shown in Fig. 76. If the kitchen fixtures had been shown in this elevation (Fig. 77) the confusion of lines would have been still greater. Even the bath trap shows very poorly, and as for showing the vent from this trap, it is almost impossible to do so clearly in this view. The only way in which it could be done with even a moderate amount of success is to work out the view on a much larger scale than is practicable. We believe that these remarks will give an idea to the student of the importance of selecting the right direction from which to view the different sections of the work.

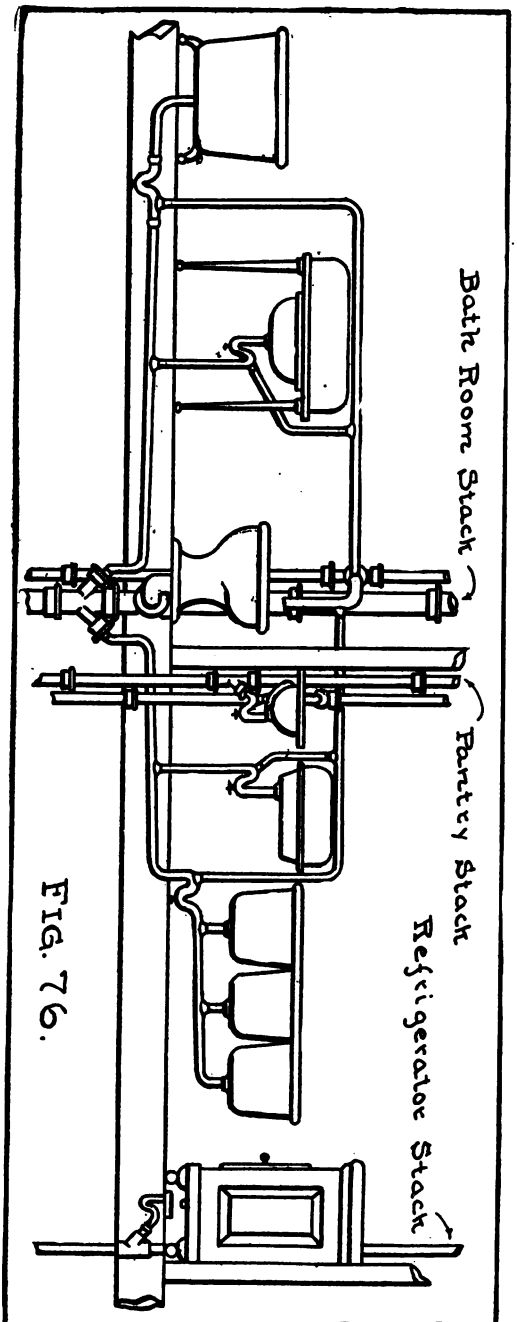

Fig. 76.

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As far as practice work on this article is concerned the student will do well to take as his exercises Figs. 74 and 75 and, if he chooses, Fig. 76 also, but he should work on a scale of about twice the size of the drawings which we show.

It is not our intention to present Fig. 77 as a practice exercise. As we have mentioned previously, if the student is inking his drawings, he should remember to draw in his curved lines before doing anything with the straight lines.

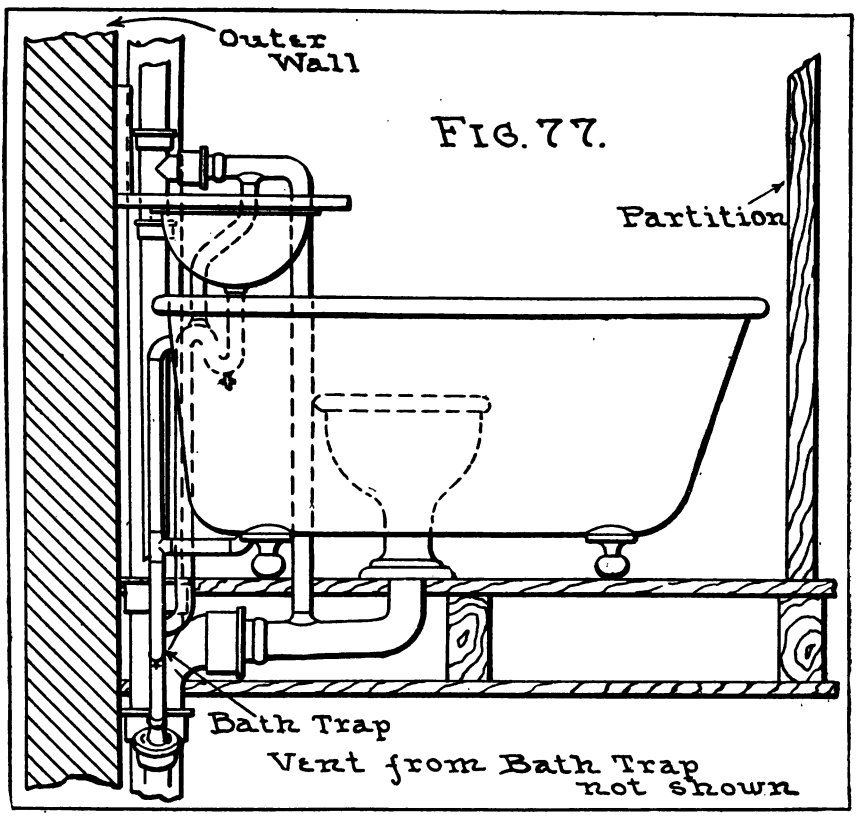

FIG. 77.

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CHAPTER XVI

ONE of the most important benefits to be derived from a knowledge of drawing as applied to the plumber, is the ability to take a set of plans and from those plans make views of the work indicated, as it will actually appear. We do not mean to infer that every plan of ordinary work will receive this attention from the plumber who is able to make such drawings, but even though he should seldom put his knowledge of the subject into actual use, the insight he has gained concerning the relation of plans and elevations will help him wonderfully in the figuring of work. This leads us to state that we shall soon take up in connection with the drawing from house plans, the figuring of stock on the same work.

In Figs. 78, 79 and 80 we show respectively the cellar plan, first floor and second floor plans of a double house. We do not present these plans as finished architectural plans, for we appreciate that many minor details of house construction are omitted, our aim being to present chiefly the details necessary to the plumber. It will be good practice for the student to draw up these plans on a larger scale. We have not drawn them at any given scale, but when we come to the figuring of work, a definite scale will be necessary. From the cellar

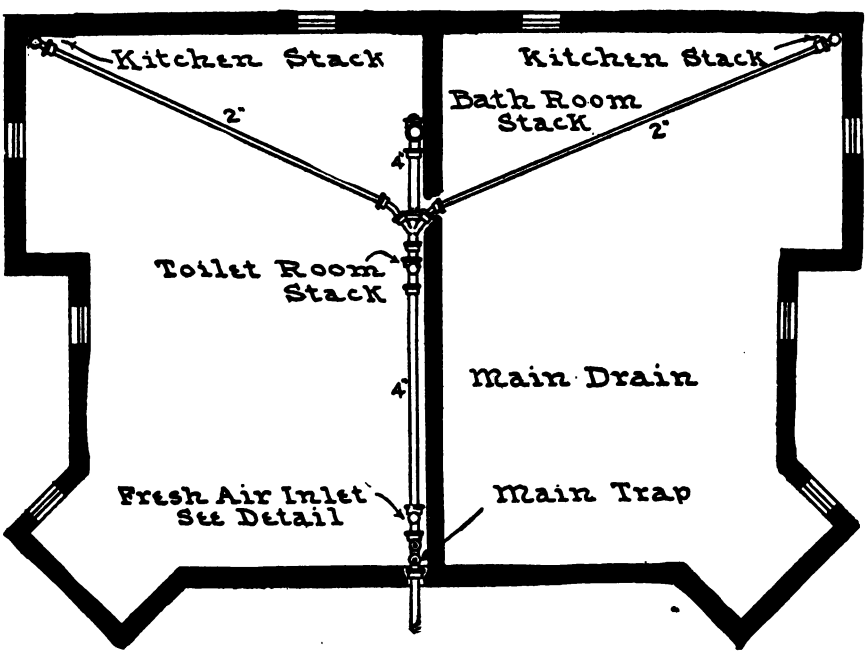

Fig. 78—Cellar Plan, Double House.

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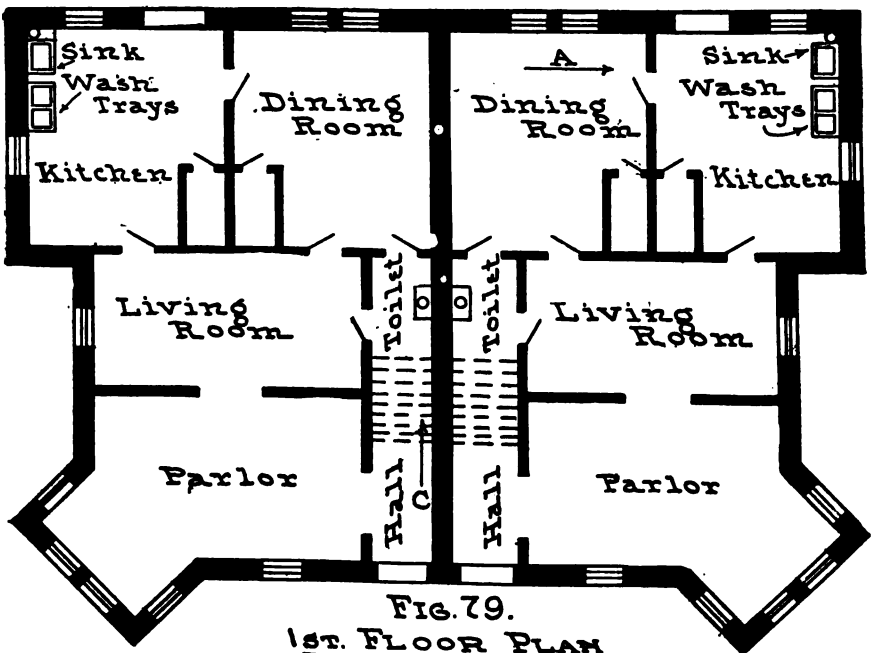

FIG. 79.
1ST. FLOOR PLAN
DOUBLE HOUSE

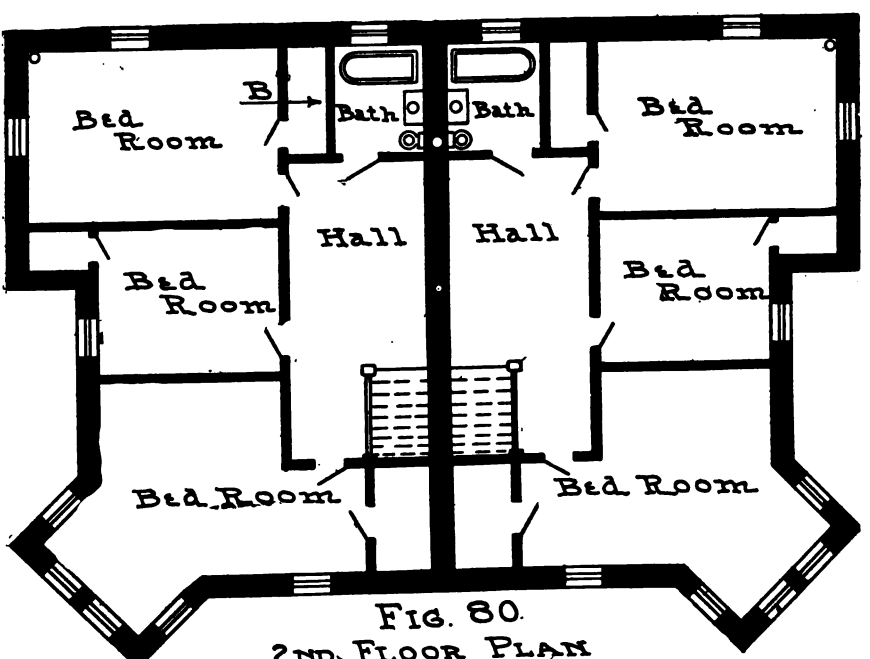

FIG. 80.
2ND. FLOOR PLAN
DOUBLE HOUSE

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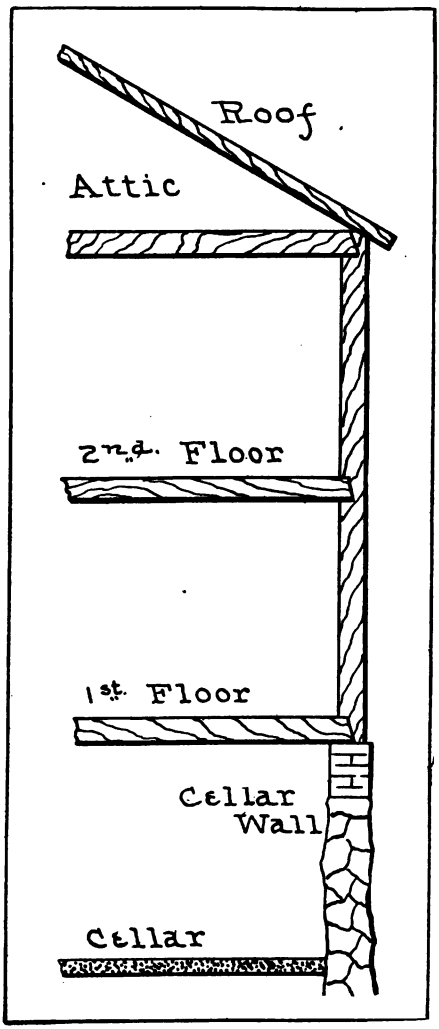

Fig. 81.—Elevation of Double House.

plan, Fig. 78, the main drain and branches and risers with their respective sizes can be found. From Fig. 81, which shows the elevation of the house, can be found the total height of the building, the distance between floors, the pitch of the roof, etc. Thus far, such a view as that given in Fig. 81, we have made little use of, but in scale drawings such as we must use in figuring work, it is of as much importance as the preceding views, for only from the elevation can the lengths of risers, etc., be obtained. From the two floor plans, it will be noticed that the plumbing is so arranged that there are four groups of fixtures. Each set of kitchen fixtures is separate from the other, with its own stack, while the two lavatories in the toilet rooms enter one stack, and the two bath rooms also one stack. In Fig. 82 we give the elevation of the work on one of the kitchen stacks. As the other kitchen work is the same, it is not necessary to show bath. The connection of the kitchen stack with the

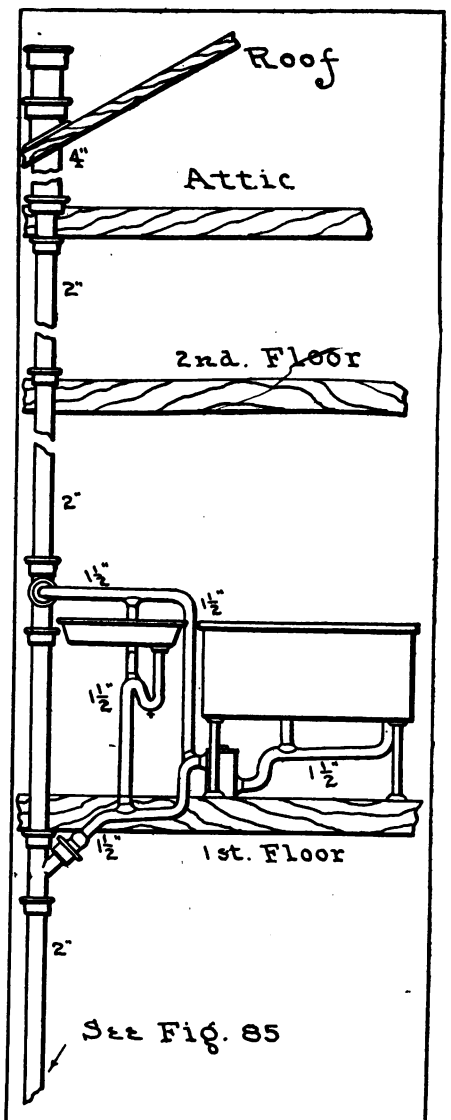

Fig. 82.—Elevation of Plumbing in Kitchen.

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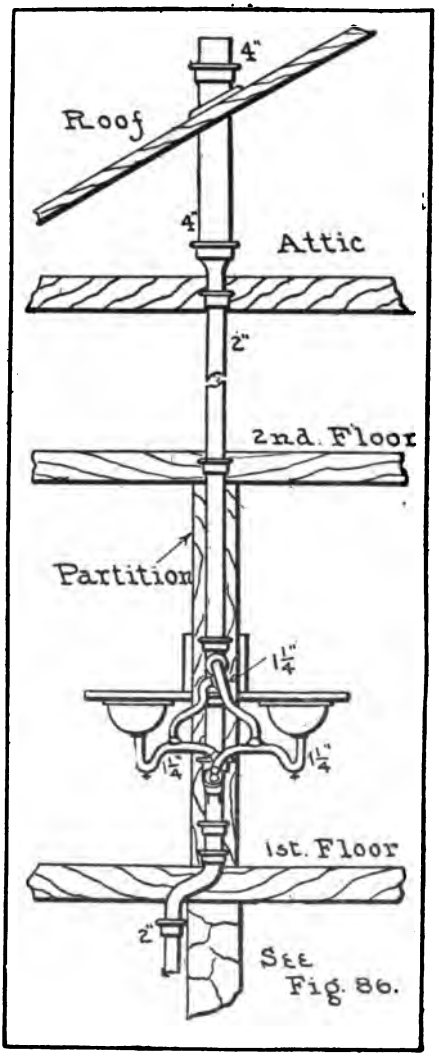

Fig. 83.—Elevation of Plumbing in Toilet Room.

horizontal line in the cellar we show enlarged in size in Fig. 85 of our next article. In order to economize space we show the stack cut off with broken lines on the second floor and in the attic, and bring the roof and attic floor and attic floor and second floor closer together than the work below. This is often done where it is desired to save space. In Fig. 83 is given the elevation of the toilet room work, the figure showing the two lavatories back to back, and the stack going up in the partition. That this stack does pass up in the partition is shown from the location of this stack in the two floor plans. As there is in the cellar a stone or brick wall dividing the cellar space, and as this wall is directly beneath the partition above, it will be seen that an offset in the stack is necessary at the first floor.

The connection of the toilet room stack is shown in enlarged detail in Fig. 86 of our next article.

It will be quickly seen by the student that the clearest view of the toilet room work can be obained by viewing it from the direction of the arrow C in Fig. 79. A view taken at right angles to this would show one lavatory behind the other, and the result of such view would not be nearly as clear as the one given.

In the view shown by Fig. 83 the Y branch into which the waste of the two fixtures is carried, points toward the front instead of sidewise, and shows in the manner given.

In getting Fig. 82 the work was viewed looking in the direction in which arrow A points in Fig. 79. This shows the two fixtures side by side, and not one in front of the other. We shall consider the bath room work and the enlarged details of special parts of this work in the next chapter.

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CHAPTER XVII

IN Fig. 84 of this article is shown the elevation of the bath room work as located in the second floor plan of double house (Fig. 80) of the preceding chapter.

This view is taken looking in the direction in which the arrow B points in Fig. 80. Any other view of the work would show the fixtures one behind the other, and would make a very confused and indistinct drawing.

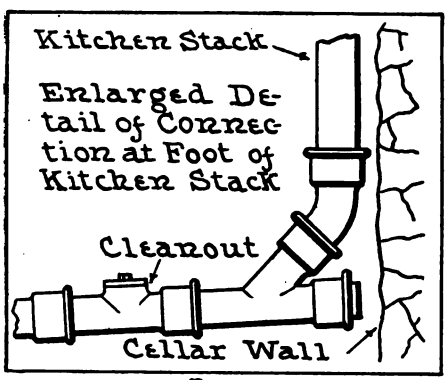

Fig. 85.

The only disadvantage in viewing the work as we have, is that the bath room fixtures on the other side of the house come directly behind those shown in our drawing, and therefore cannot be represented. In this case, however, it is not essential that more than one of the two sets of fixtures should be shown, for the two are exactly alike, and no additional benefit is to be derived from showing the rest of this work.

The connection of the bath room stack into the main drain in the cellar is shown enlarged in Fig. 86.

As in the case of the toilet room stack of our last article the location of the bath room stack, on the two floor plans, shows that it must be offset on the first floor, to get around the dividing wall. While it is impossible on the drawing itself to show that a double T Y is used for the two water closets, and a double Y for the other

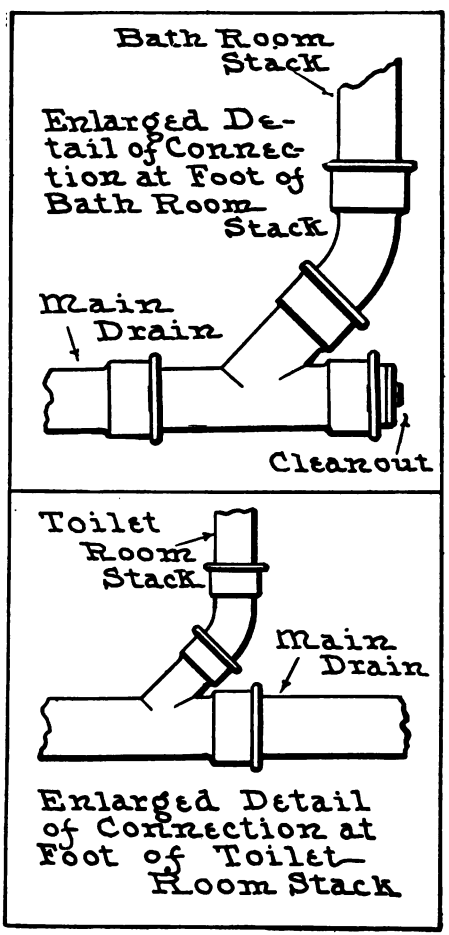
Bath Room Stack
Enlarged Detail of Connection at Foot of Bath Room Stack
Main Drain
Cleanout
Toilet Room Stack
Main Drain
Enlarged Detail of Connection at Foot of Toilet Room Stack

Fig .86.

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fixtures, it will be noticed that these matters are made known by lettering on the room fixtures is carried into the attic before entering the main stack, instead of entering it in the bath room. This is often done and even required in some cities, to provide means of properly venting fixtures that may be installed above at some future time, as may be required.

Now let us turn our attention to the enlarged details of special parts of the work, as shown in Figs. 85, 86 and 87. It often happens that drawings drawn on a small scale, such as we must use in our illustrations of these articles, cannot show fully enough certain details, and in

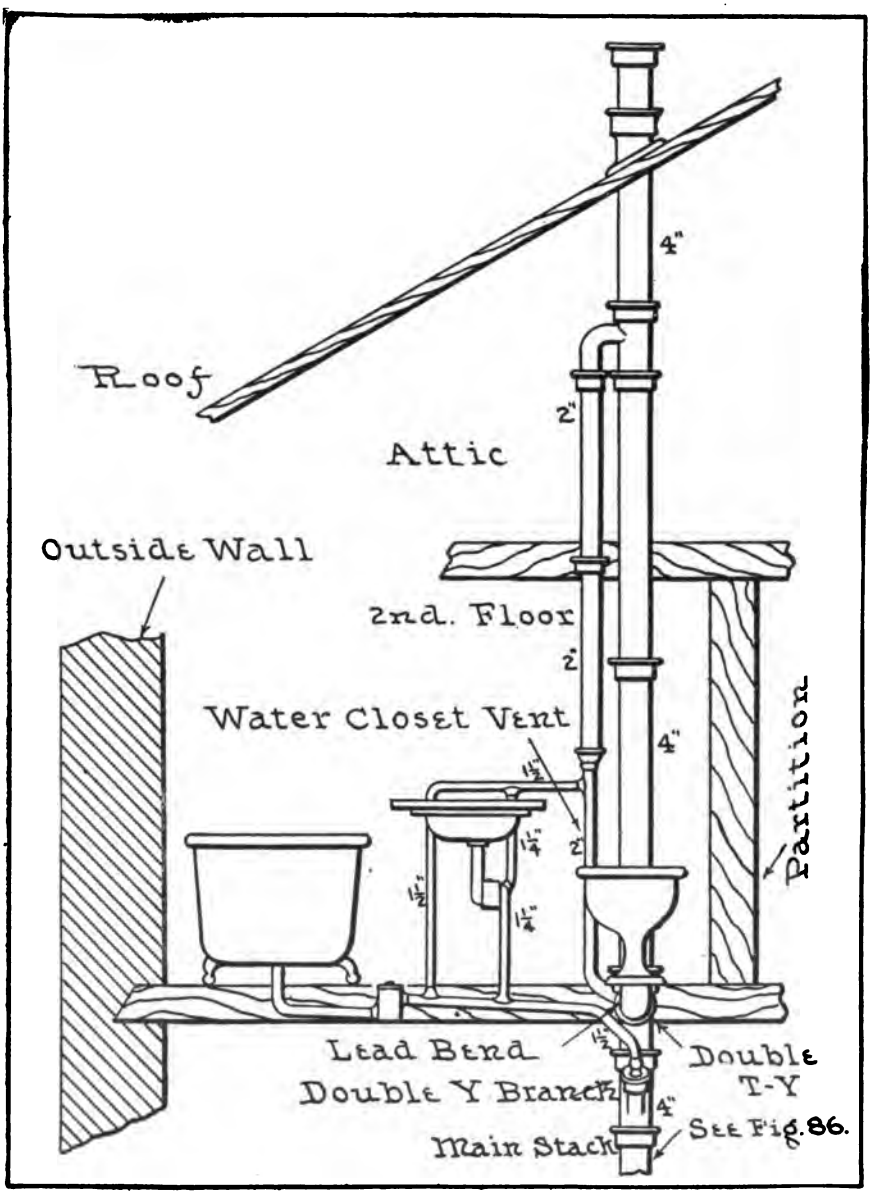

Fig. 84.—Illustration Showing Elevation of Plumbing in a Bath Room.

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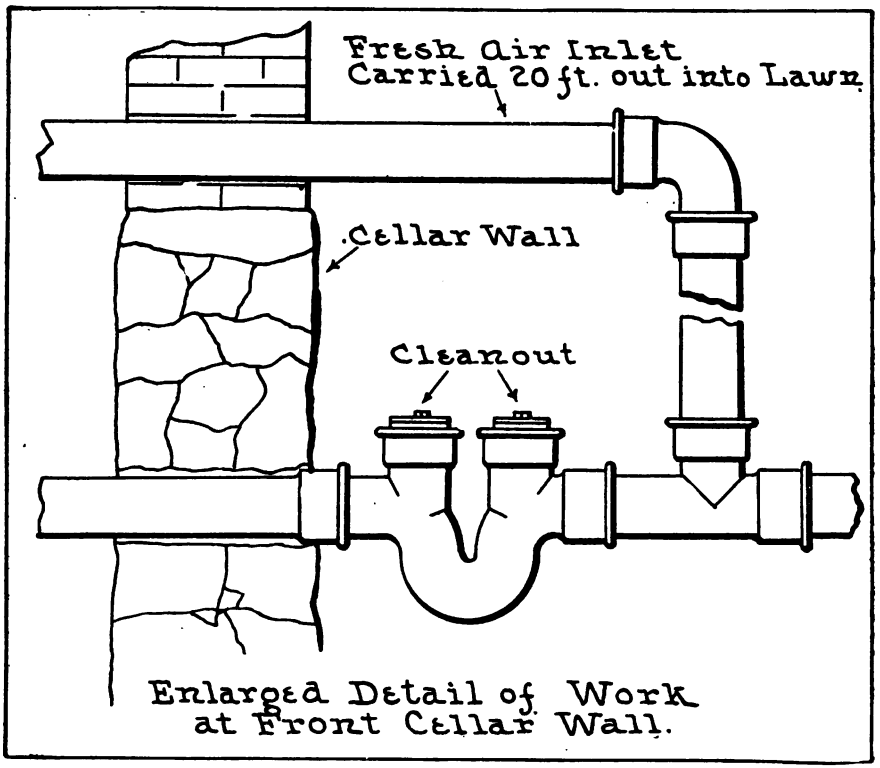
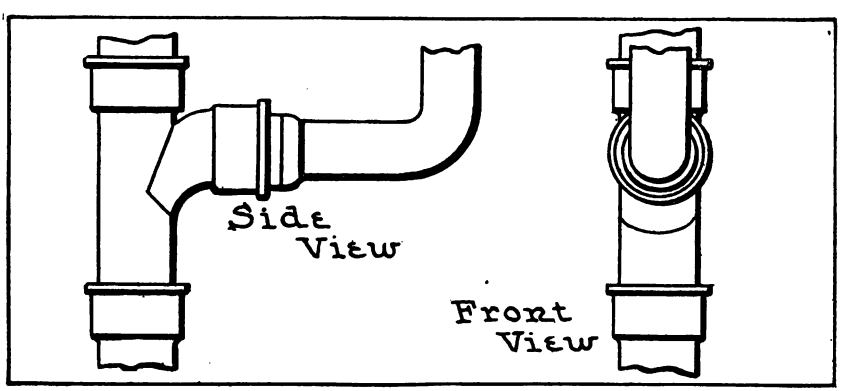


Fig. 87.



Mechanical Drawing for Plumbers.—Fig. 89 Shows a T Y With Lead Bend Entering it.

such a case, it is customary to show a special drawing of such part of the work enlarged.

In the case of Fig. 85, the horizontal line runs so close up to the cellar wall that there is no chance to use an end cleanout, and a horizontal cleanout must be used. As so often happens in an architect's plans, this cleanout has not been shown on the cellar plan, as it should be. This simply shows that wherever detail drawings are given they should be given full attention.

Concerning Fig. 86, all there is to be

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said is that this foot connection cannot be shown on a cellar plan with any degree of clearness, and it is necessary either to give a detail or to show the connection on the respective elevations.

Regarding Fig. 87, it will be seen on referring to the cellar plan, Fig. 78 of the preceding article, that on this plan the fresh air inlet would show directly above the main drain, and therefore to show clearly an elevation of this part of the work must be given.

It will be good practice for the student to work out all the work shown in this chapter.

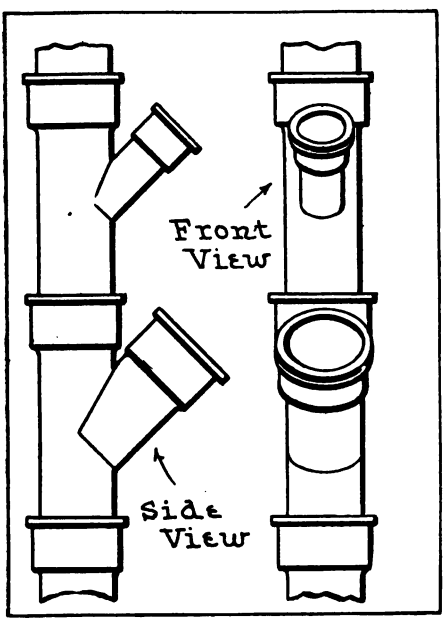

Fig. 88.

Fig. 84 can be shown twice as large as given, but the remaining sketches can be drawn up in the same size as we present them.

We might add here, that in working up his drawings, the student would do well to practice lettering, following the style of lettering used on our illustrations, for it is a fact that a man may make a fine-looking drawing and spoil its entire appearance by poor lettering.

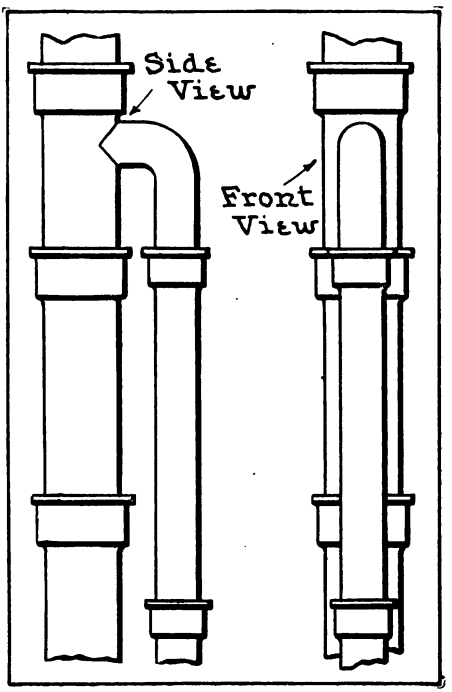

Fig. 90.—Main Stack and Vent Entering in Two Positions.

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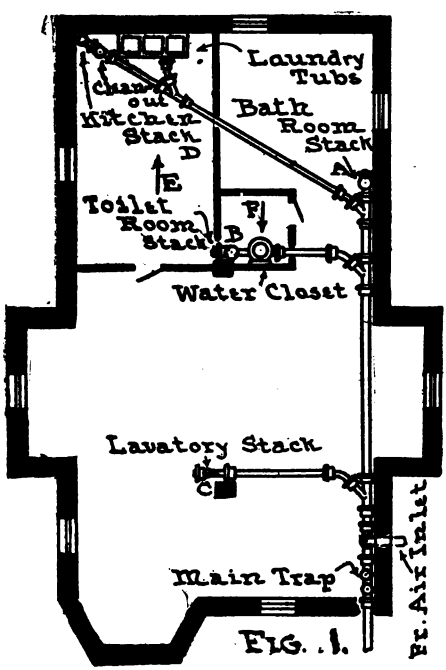
CHAPTER XVIII

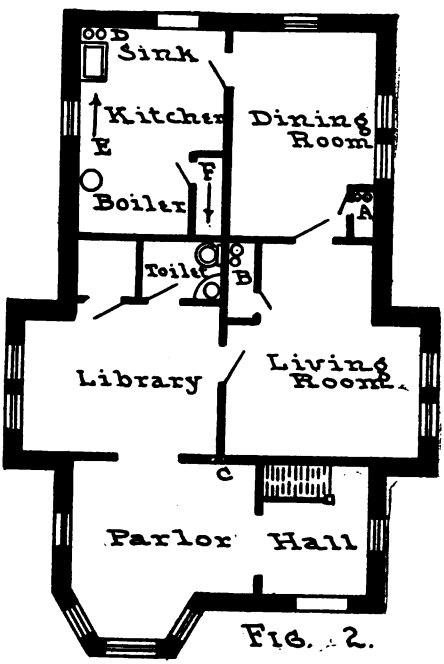
FOR the work on this chapter and the one following, we propose to take up the plumbing of a residence, and show it in full, believing as we do, that this branch of the work is fully as important to the plumber as any that we have taken up. For this purpose we show a full set of plans for such a residence, Fig. 1 representing the cellar plan, Figs. 2 and 3 and 4 the floor plans, and Fig. 5 the front view or elevation.

In this and the following chapter we shall show separate elevations of the different stacks, in each case taking these views from the most advantageous point of view, and before leaving the subject of the plumbing for this residence, we shall show a single elevation of the entire work of the house, taken from one view point. Now in Fig. 6 we shew an elevation of the work in the kitchen on the first floor, and the laundry in the cellar. These fixtures are so located that they can be shown to advantage in the one view, which is obtained by viewing the work from the direction of the arrow E, which appears on both cellar and first floor plan.

Instead of using up valuable space in showing floors above the first floor, and



CELLAR PLAN OF RESIDENCE



1ST. FLOOR PLAN OF RESIDENCE

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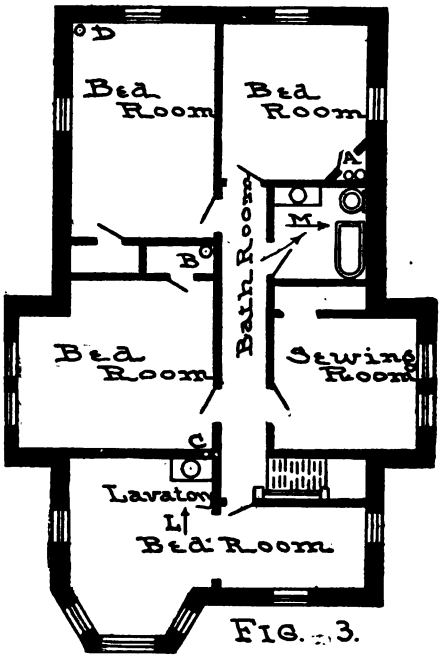

FIG. 3.

2ND. FLOOR PLAN OF RESIDENCE

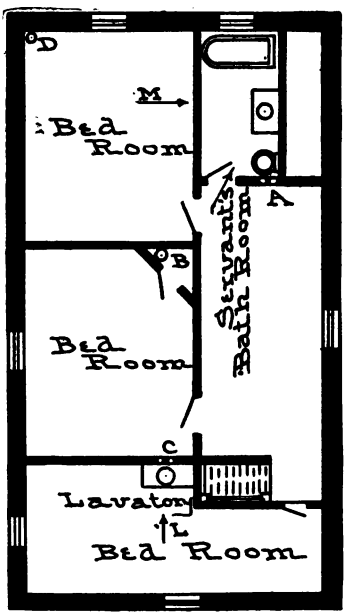

FIG. 4.

3RD. FLOOR PLAN OF RESIDENCE

also the roof, in order to show the roof connection for this stack, and also for the one in Fig. 7 we show by a note how they are to be run.

Fig. 7 represents an elevation of the water closet located in the cellar, and the toilet room located on the first floor. The stack serving the toilet room passes up on one of the cellar piers, as shown by the cellar plan, and this fact is also shown on the elevation. The stack is run on the first floor through the closet, and also through closet on the two floors above. This stack is designated on the several floor plans as stack B. Now if the student will measure with his dividers from the side of the first floor plan (Fig. 2) to the center of this stack, and then do the same thing on the second floor plan (Fig. 3) he will find that on the latter the stack is located further to the left. This is in order that the stack may be run in a convenient place, and at once shows that at the second floor the stack

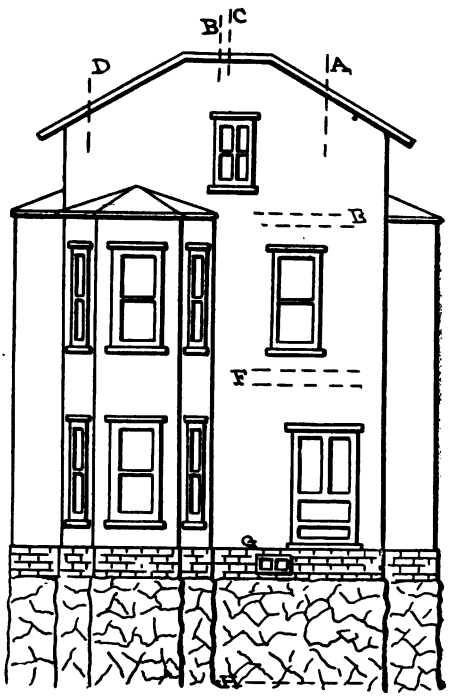

FIG. 5.

FRONT ELEVATION OF RESIDENCE

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must be offset toward the right. A glance at the third floor plan will show the location of B is the same as on the second plan, showing that from the latter point it runs straight up.

The work shown in Fig. 7 is obtained by viewing it in the direction of the arrow F, which appears in the cellar and first floor plans. The reason for choosing this direction instead of one at right angles to it, is that in the latter the 4-inch pipe under the cellar bottom, into which the water closet wastes, would appear endwise instead of giving a clear view from the side, as it now does. However, in taking the view as we have, it brings the lavatory in the toilet room behind the water closet, and the main vent line behind the main stack, but this is not a serious matter in the least, for wherever hidden, as in this case, the work can be shown by dotted lines. Fig. 5, which we shall use later on, gives all necessary vertical dimensions, the several floors be-

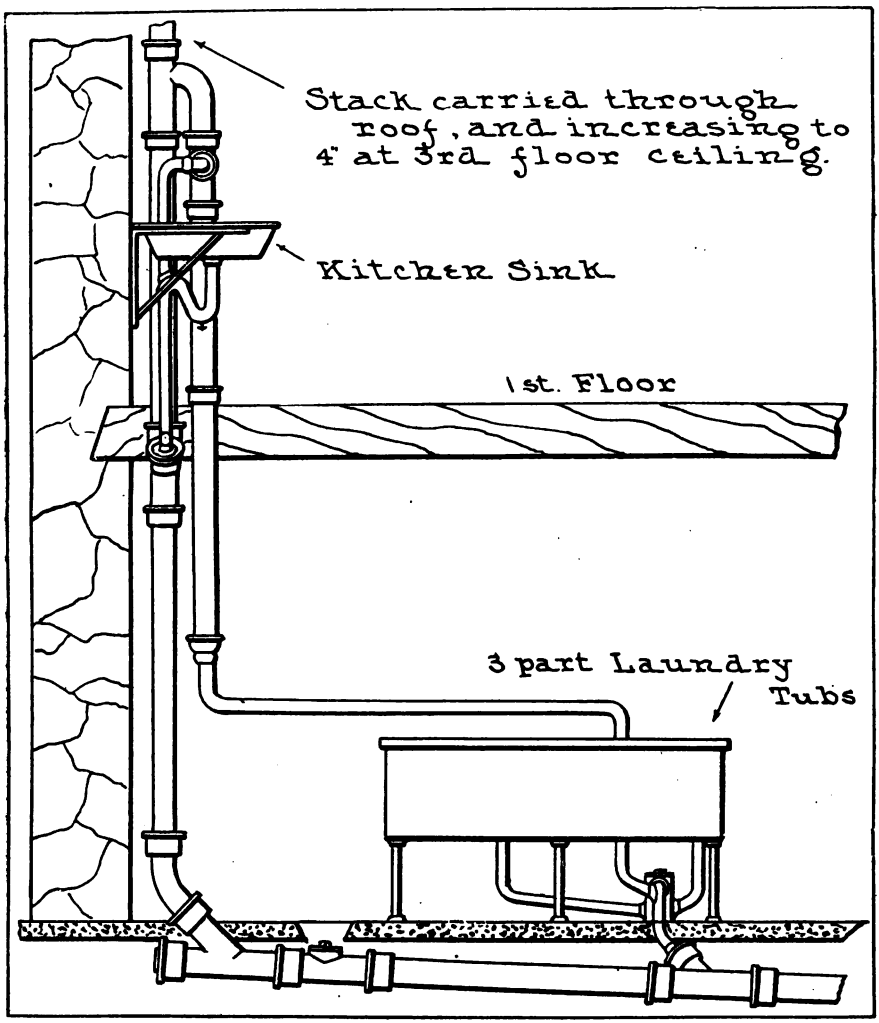

FIG. 6. ELEVATION OF KITCHEN AND LAUNDRY FIXTURES.

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ing represented by the letters E, F, G, and H, and the points on the roof where the several stacks come up being shown by the letters A, B, C, and D. This latter information will be valuable in figuring stack, as the vertical runs of pipe can be found by noting at what heights the stacks come through the roof.

We would advise the student to practice on all the work shown in illustrations.

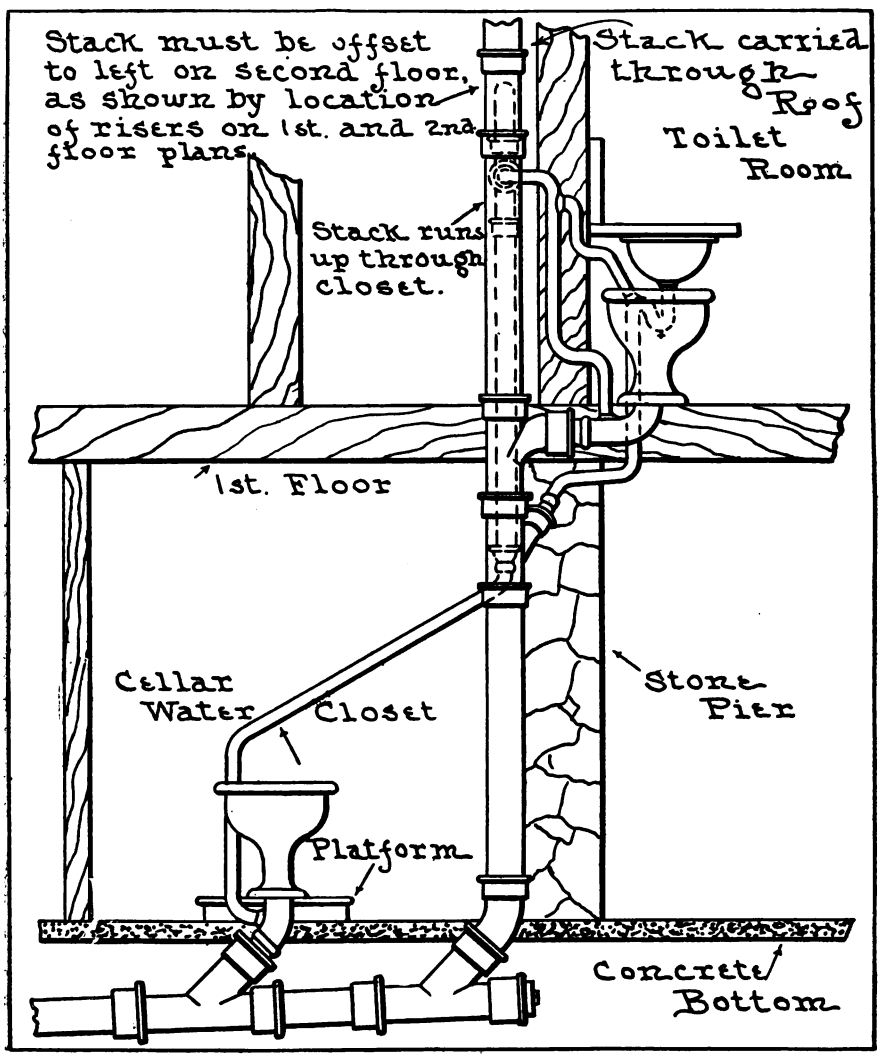
Stack must be offset to left on second floor, as shown by location of risers on 1st. and 2nd. floor plans.
Stack carried through Roof
Toilet Room
Stack runs up through closet.
1st. Floor
Cellar Water Closet
Stone Pier
Platform
Concrete Bottom

FIG. 7. ELEVATION OF TOILET ROOM FIXTURES AND CELLAR WATER CLOSET.

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CHAPTER XIX

TO complete the elevations showing the plumbing work of the residence which was taken up in the chapter preceding this, we have prepared Figs. 8, 9 and 10. Fig. 9 shows the elevation of the two lavatories served by stack *C* on the second and third floors. In this elevation we have shown the main line of back air pipe connected at its lower end, back into the stack, which makes a better piece of work than the method shown in the elevations of the last article. While in this series our chief attention is given to the matter of drawing, it is our intention also to show work of varied nature, hence the two methods mentioned above.

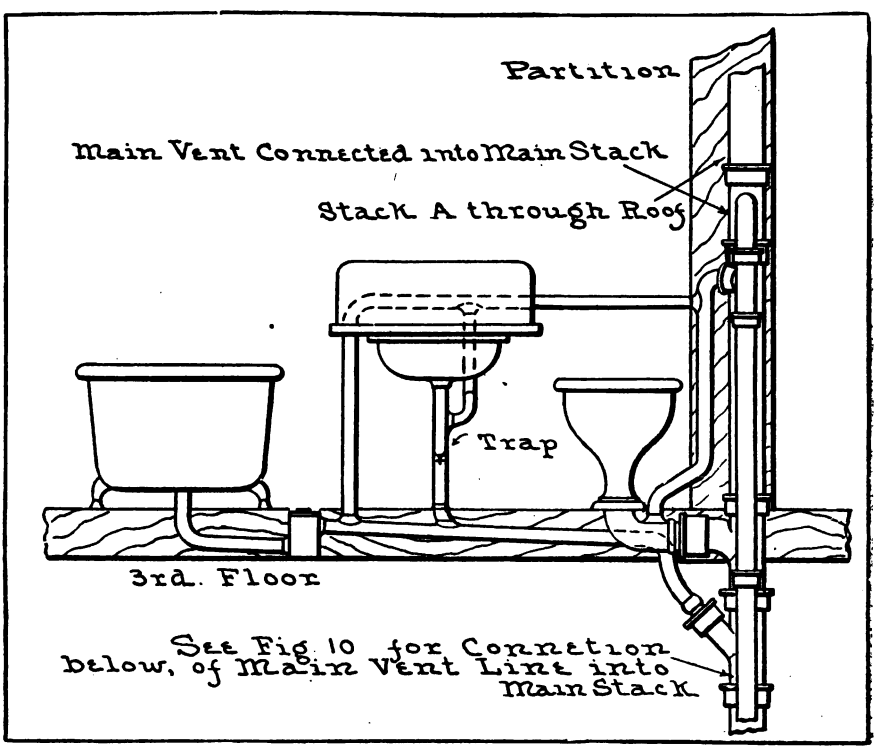
Partition
Main Vent Connected into Main Stack
Stack A through Roof
Trap
3rd. Floor
See Fig 10 for Connection below, of Main Vent Line into Main Stack

FIG. 9 ELEVATION OF SERVANTS' BATH ROOM - 3RD. FLOOR.

The only other point in connection with Fig. 8 that we wish to bring out is the view which is obtained of the two lavatory traps. The view of these two fixtures is taken in the direction of the

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arrow "L" which shows in Figs. 3 and 4. Viewed from this direction, the traps do not stand so that their full shape appears, but as shown in Fig. 8. While strictly adhering as a general thing to the exact appearance of an object of this nature in our work, it will often be found of advantage to depart from this rule, and in such a case as this, to show the shape of the trap. Instead of showing the two bath rooms on the second and third floors in one elevation, we show each separately in Figs. 9 and 10. This is done simply to save space. The third floor or servants' bath room is viewed along the direction of arrow *M* in Fig. 4, which gives us a very clear view of the work. In this view the main back air line stands in front of the main stack, and we attach a note showing where the connection of the former with the latter may be found. In the same way we show a note on Fig. 5 indicating where the upper connection between these two lines of pipe may be seen. As this shows, a note of this kind may often take the place of the drawing itself. The view shown by Fig. 10 is taken along arrow

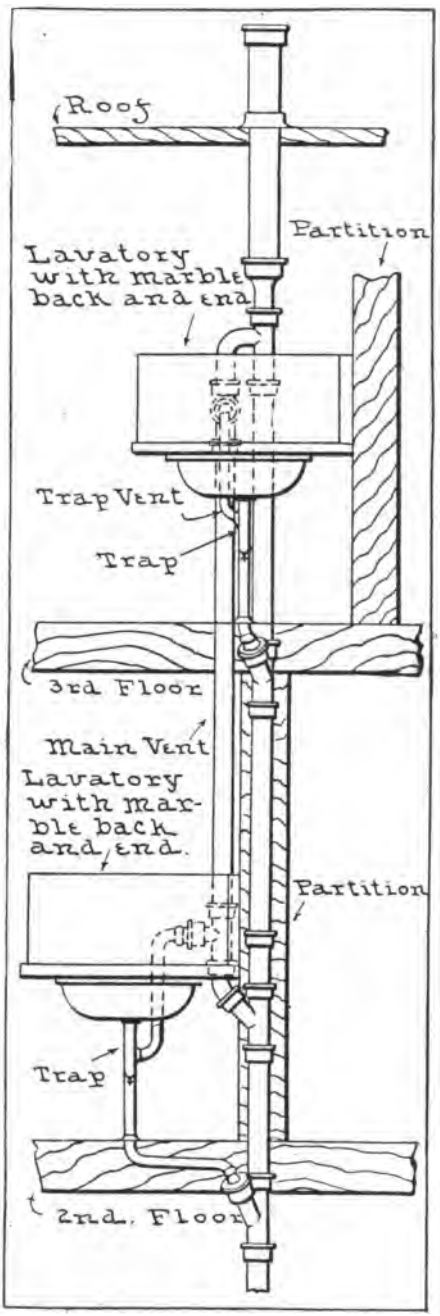

FIG. 8. ELEVATION OF 2ND. AND 3RD FLOOR LAVATORIES

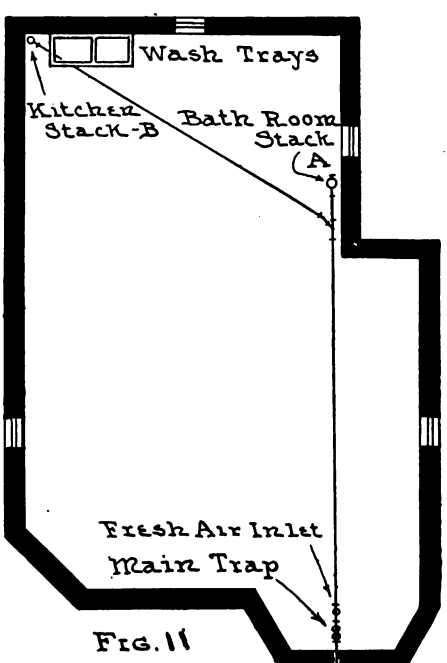

FIG. 11

CELLAR PLAN OF COTTAGE HOUSE

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M in Fig. 3, and as compared with Fig. 9, does not show the work so clearly, although to the best advantage considering the relative locations of those fixtures. In our next article we shall show one complete elevation of the entire work of this residence, from which comparison may be made as to clearness of view and distinct understanding of the work, with the method of showing the same work in separate elevations, as we have just done.

We believe that we have reached a point now where the student of this series of articles will have had enough experience to enable him to go ahead and work out the proper views of a simple plumbing system with little help from the writer.

To this end we submit Figs. 11, 12, 13 and 14, showing the cellar and floor plans and front elevation of a cottage house. It is expected that after drawing up these plans on a larger scale the student will make the necessary views by which the entire plumbing system of the house may be shown to the best possible advantage.

We have shown the piping in the cellar as a single line, and it would be well to elaborate this part of the work in redrawing the cellar plan, showing the piping by double lines, as we have generally done in our previous drawings, and showing all fittings.

As will be seen from these plans, the plumbing of the house consists of the wash trays in the cellar, the kitchen and pantry sinks on the first floor, and the three bathroom fixtures on the second floor. Show on this work, roof connections and increase of size of stack where necessary, also connection of main vent into stack if the work is to be so constructed. Also show the work at the front cellar wall clearly. We would advise including the wash trays and kitchen sink in one elevation, and the bath room fixtures and pantry sink in another. The student must use his judgment in selecting the right point for viewing each part

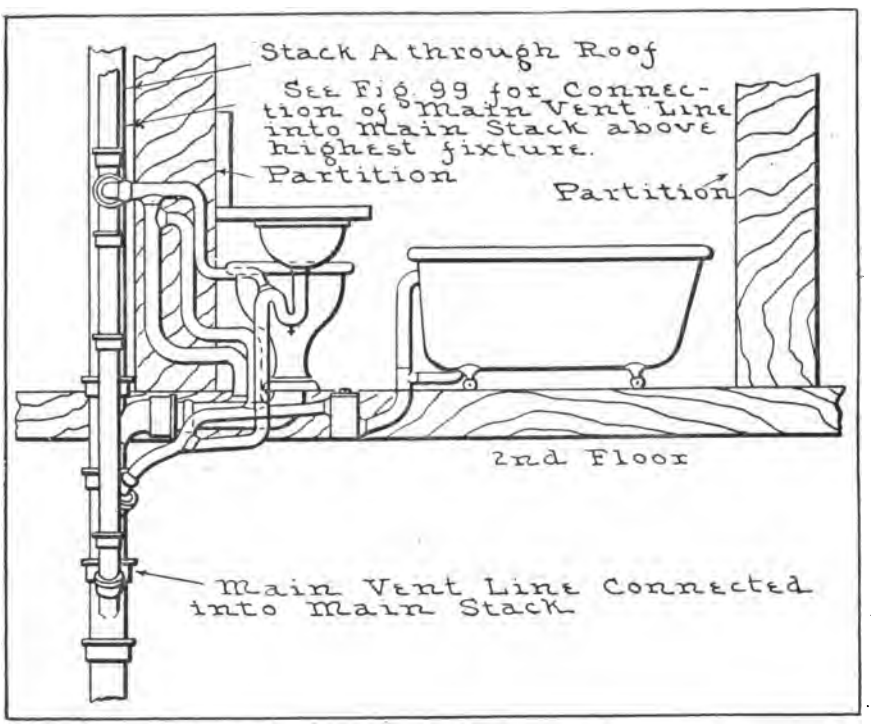
Stack A through Roof
See Fig. 99 for Connection of Main Vent Line into Main Stack above highest fixture.
Partition
Partition
2nd Floor
Main Vent Line Connected into Main Stack

FIG. 10 ELEVATION OF BATH ROOM ON 2ND. FLOOR.

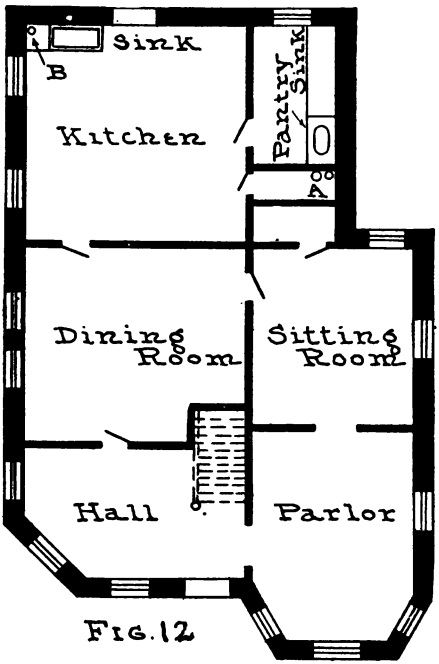

FIG. 12

FIRST FLOOR PLAN OF COTTAGE HOUSE.

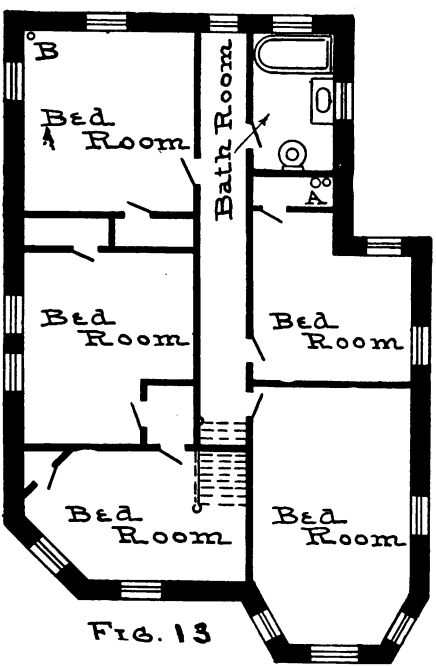

FIG. 13

SECOND FLOOR PLAN OF COTTAGE HOUSE

of the work so that the drawing will show the work as clearly as possible.

The elevation of the house shown in Fig. 14 shows by the letters *A* and *B* just how high up on the roof the two stacks come through, and by the letters *C*, *D*, *E*, and *F* the several floors.

Such work as this, we believe, will be of the greatest benefit to any man following this series, and we believe that if he has followed carefully what has gone before, in the preceding chapters, he can handle the work without much difficulty.

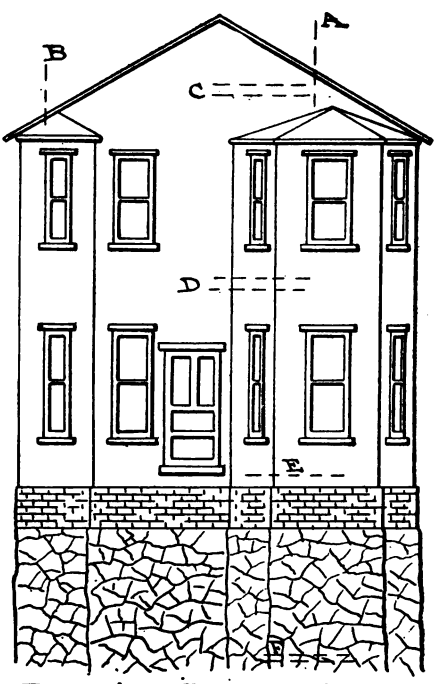

FIG. 14 FRONT ELEVATION OF COTTAGE HOUSE.

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CHAPTER XX

IN Fig. 105 we present the elevation mentioned in the preceding chapter. As will be clearly seen, this one elevation shows the entire plumbing system for the residence, which we have been considering in the last two

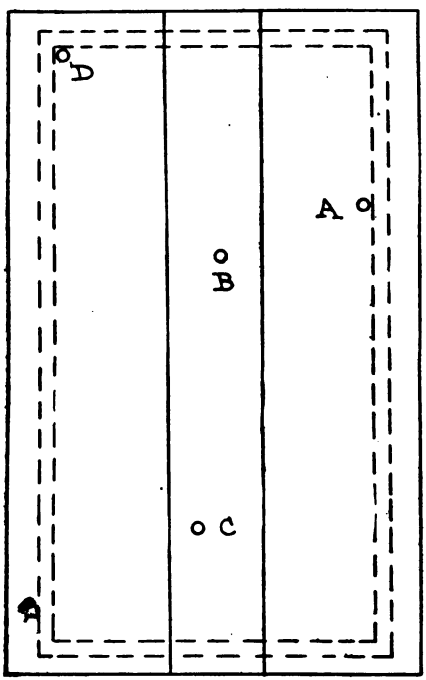

FIG. 106.
ROOF PLAN OF RESIDENCE

articles, and has been obtained viewing the work from the left-hand side of the house. We have chosen to view this work from the side mentioned rather than from the front of the house, principally for the reason that a view taken in the latter direction would show the main line of soil pipe in the cellar on end, whereas in the present view it appears in such a way as to show it lengthwise. The reader will see very clearly that about all that could be seen of the main line from the front position would

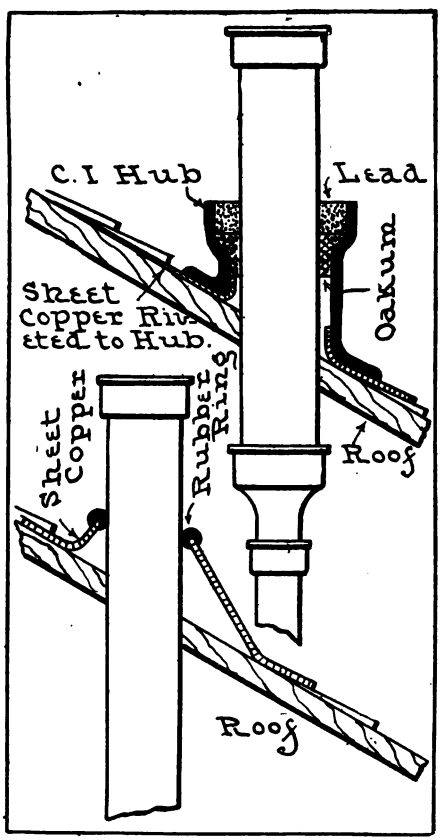

FIG. 107.

be the end of the pipe, and that in such a view none of its length would be seen. However, it is seldom that a view of a system of plumbing of the extent of

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this one can be taken from any one direction so that all parts of the work will show to the best advantage.

For instance, in the elevation shown by Fig. 105, in the main lines of vent pipe serving the fixtures connecting into stacks *C* and *D*, appear behind these stacks, and as the main vents in these two cases are the same size as the stacks they cannot be seen. To get around this point we have shown these two lines a little to one side of the stacks. This is not strictly according to the letter, but as it results in a clearer showing of this part of the work, it is admissible.

Stacks *B* and *C*, as will be seen from Fig. 91 of a preceding chapter, enter horizontal branches in the cellar, which connect into the main line for soil pipe. In Fig. 105 we get simply the end view of these two horizontal branches, and the horizontal branch into the main line from stack *D* running at an angle as it does, has to be shown as our illustration gives it. The fresh air inlet does not show to the best advantage in Fig. 105, and neither does the offset on stack *A*.

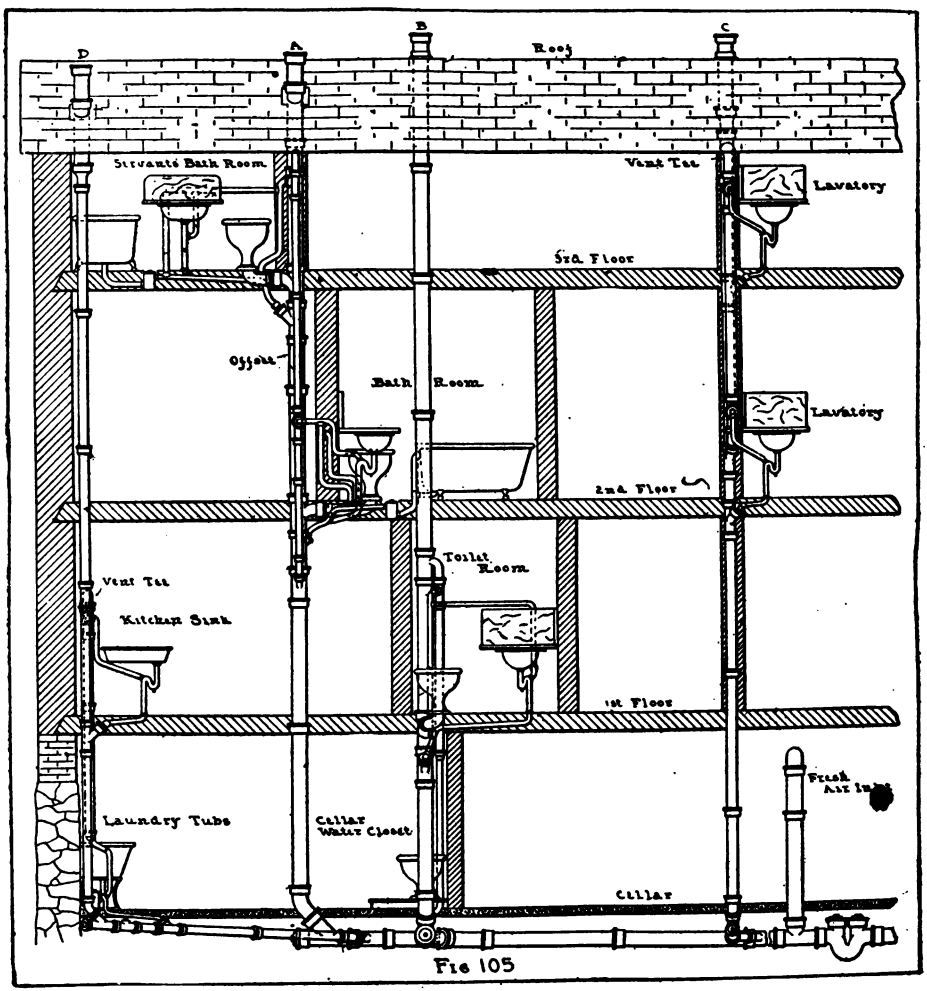

Fig 105

The two bath rooms probably show to better advantage in this view than would be possible if it were taken from any other direction.

A glance at the front elevation of this residence, Fig. 95, will show the shape of

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the roof and the points on the roof where the stacks come up.

A comparison with the roof shown in Fig. 105 will show that the stack *B* and *C* pass through the flat portion of the roof, while the stacks *A* and *D* pass through the roof on the pitch.

Having considered in a brief way, these several points concerning Fig. 105, we believe that our readers will agree with us that excepting under favorable conditions

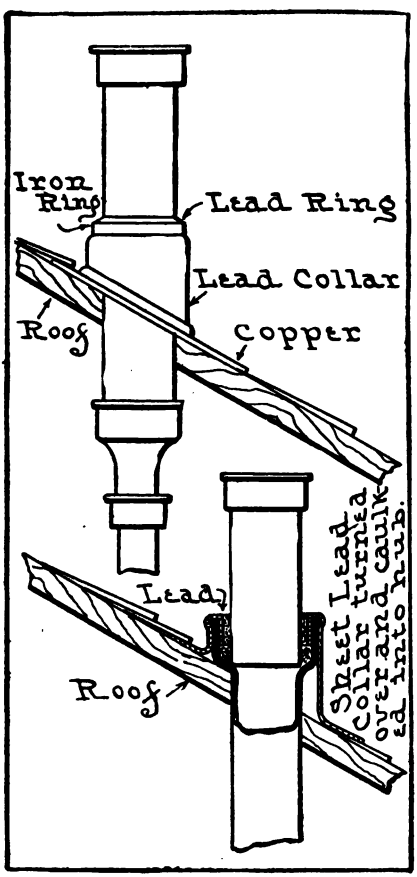

Fig. 108.

the work of such a system as the one shown in our illustration is shown more clearly and to better advantage by making separate elevations of different parts of the work, viewing the several parts from the most advantageous position, rather than to show it all in one elevation. However, it sometimes happens that such a view as Fig. 105 is preferable for some reason or other to separate elevations, so we must take the matter into consideration in connection with this work.

We do not think it would be advisable to take Fig. 105 as a practice exercise by our students, their attention being placed to better advantage on work that they will have more use for.

Our mention of the several points at

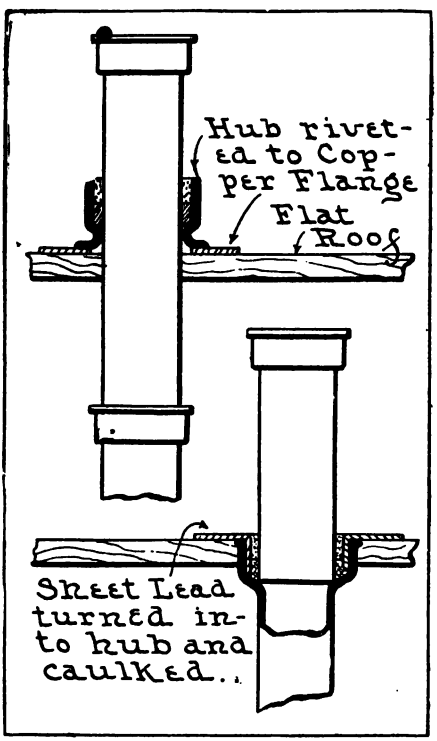

Fig. 109.

which the stacks pass through the roof brings to mind the fact that a roof plan is sometimes very useful in showing this location. We therefore present Fig. 106 as a roof plan of the residence, of which we have been showing plans and elevations. This plan shows the exact location of the four stacks, *A*, *B*, *C* and *D*.

While dealing with this part of the work it will be well to take up the subject of roof connections, and to that end we show several methods of doing this

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work, in Figs. 107, 108 and 109. The two roof flanges or shoes, shown in Fig. 107 and the upper one in Fig. 108, are patent devices, and in the case of the two first mentioned, we have shown sectional views, to better represent them. The other connection of Fig. 108 shows a roof connection made from ordinary sheet lead. In Fig. 109 we have shown two methods of roof connection for flat roofs, those preceding having been or pitch roofs. The upper method shows a patent flange, while the other gives a method for using sheet lead.

Figs. 107, 108 and 109 will give the student good practice work, and we advise in connection with it the making of sectional views, such as we have given.

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CHAPTER XXI

A PROBLEM which brings in a few points not heretofore covered by the work which we have taken up, is that of a six-flat apartment building. This style of building, laid out after the style which we show, is very common, and the six-flat building will all three floors, as the plumbing of each is identical.

In the cellar plan is shown in addition to the main drain and branch lines to the kitchen stacks, the rain leaders, the cellar drainage and sub-soil drainage systems, and the drip sinks which are pro-

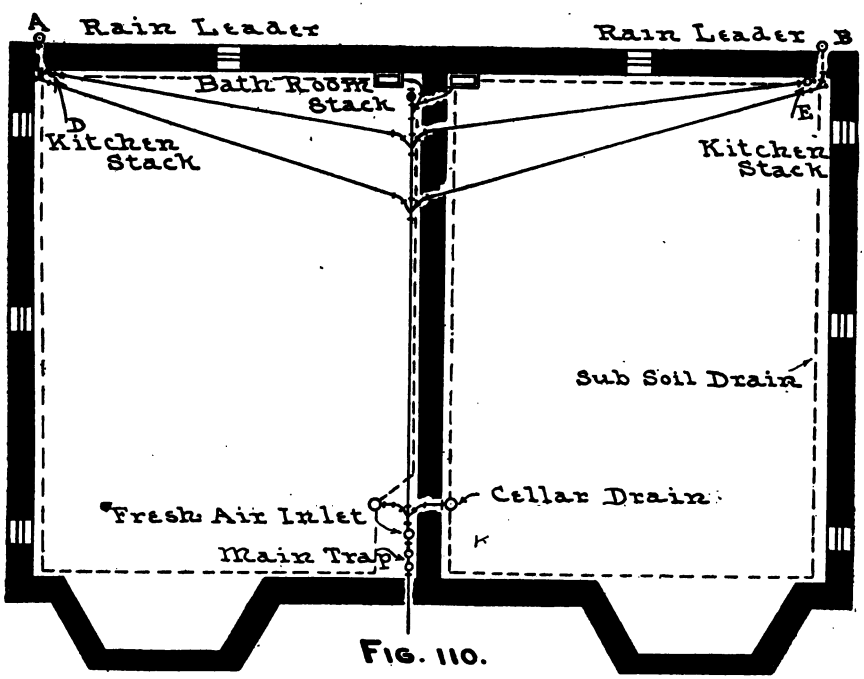

FIG. 110.

CELLAR PLAN - SIX FLAT APARTMENT HOUSE.

serve to show equally well what would be found in buildings containing a larger number of apartments.

Figs. 110 and 111 give respectively the cellar plan and floor plan of the building in question, one floor plan serving for

vided to receive the drip from the refrigerator lines.

Most plumbing ordinances, by the way, require that a sink used for such purposes shall be supplied with water. This of course is done, so that during the

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winter months when the refrigerators may possibly not be in use, the danger of the evaporation of the seal in the sink trap may be lessened. As to the sub-soil drainage, in some sections of the country it is hardly ever used, but in others, where there is a damp soil, nearly every house or building must be supplied with it. The dotted lines showing the sub-soil drain represent porous tile with loose joints, and it will be noticed that this drain is carried into the well formed for the cellar drainage. Other lines of the work. Probably most of our readers will agree that in figuring such a job as this one, it would be the easiest thing in the world to forget to figure in the Y branch and bend making up this offset. With a drawing, even if it is not elaborately drawn, this and a score of other little points are brought to one's attention, and "forgetting to figure" fittings, etc., will not happen so often.

Probably by this time those of our readers who have been carefully preserving this book will see at a glance that the

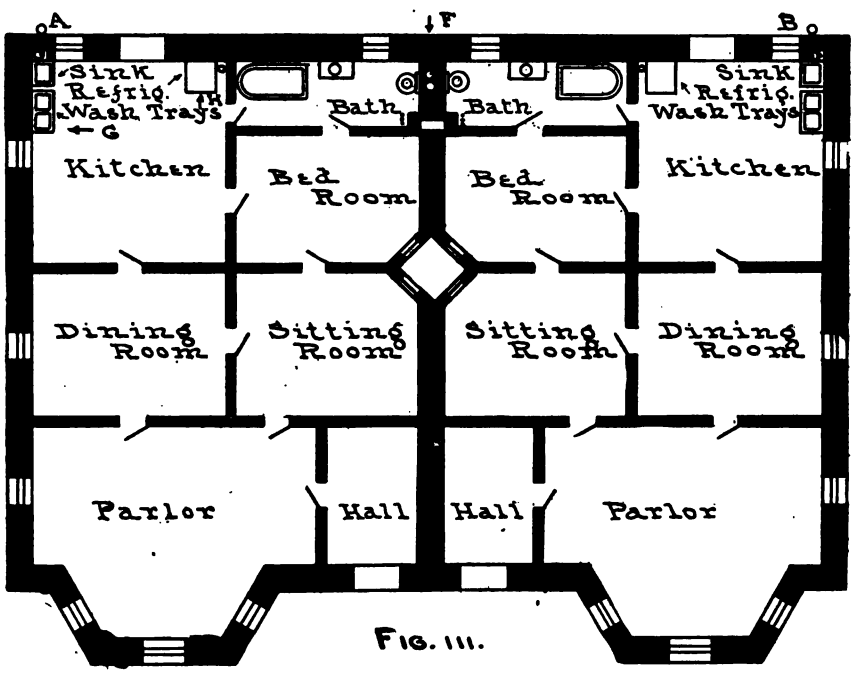

FIG. 111.

FLOOR PLAN
SIX FLAT APARTMENT HOUSE

sub-soil drain may be run out into the center of the cellar if desired.

In Fig. 112 is shown an elevation of the plumbing work of the kitchens. As will be seen from the floor plan, the kitchens belonging to the two apartments on each floor are at opposite ends of the building, and therefore require separate stacks, and as these stacks run in recesses in the wall, they require offsetting below the first floor, as we show. This matter of the offset will perhaps show in a slight way the benefit of a drawing of elevation of Fig. 112 is taken looking in the direction of the arrow G in Fig. 111. This brings the stack and the vent line one behind the other, and for that reason the work does not show as clearly as might be desired. The vent line it will be noticed, does not connect at its foot back into the stack, but as shown, ends in a hub ferrule, to which the two fixture vents connect.

To be brief and to the point, we show in Fig. 112, and also in Fig. 113, only the work on the lower, and upper floors, and

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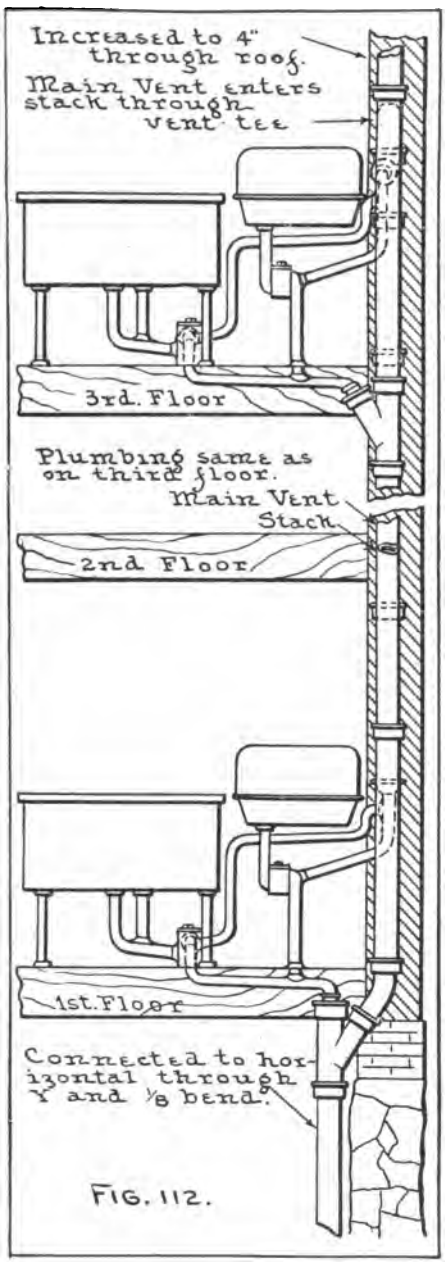
instead of showing the stacks passing through the roof, simply designate that point by an accompanying note.


Increased to 4" through roof.
Main Vent enters stack through vent tee
3rd. Floor
Plumbing same as on third floor.
Main Vent Stack
2nd Floor
1st. Floor
Connected to horizontal through Y and ⅛ bend.
FIG. 112.

ELEVATION OF KITCHEN WORK.

In Fig. 113 we show an elevation of the bath room work of the apartment building under consideration. On this work, the bath rooms on each side of the house are served by a single stack, as our drawing shows.

It will be observed that this view of the work is obtained by looking upon it from the rear (see arrow F). As we saw in the case of the kitchen stacks, the bathroom stack runs up through the wall, and of necessity must be offset in order to lead into the main drain. In this drawing, the main line of vent appears in front of the stack, and therefore shows plainly. Just below the first floors two lines of vent are connected into the main vent, these pipes being the vents from the refrigerator drip sinks in the cellar. The work shown in all four drawings of this chapter are given the student for practice work, which will be found easier if made on a larger scale. We have said but little on scale drawings thus far, but before one can take up the figuring of work from drawings, it becomes necessary to understand this matter. Therefore, in our next chapter we shall take the subject up to a sufficient extent to enable the student to use a scale in his work.

It has probably been noticed that we have for some little time been showing lines on floor timbers in our drawings, which represent wood. This is not a necessity by any means, but a reference to Figs. 112 and 113 will convince the reader, we believe, that it sets off a drawing to quite an extent, and adds to its appearance.

Likewise, the section lines of the division wall shown in Fig. 113 are of benefit, as well as the lines showing brick and stone work.

The cross section lines take quite an amount of time to put in in proper shape, to be sure, but the lines showing wood and stone are very quickly put in.

Some of the detail work connected with the six flat apartment building which we have been considering, we shall show in the next chapter.

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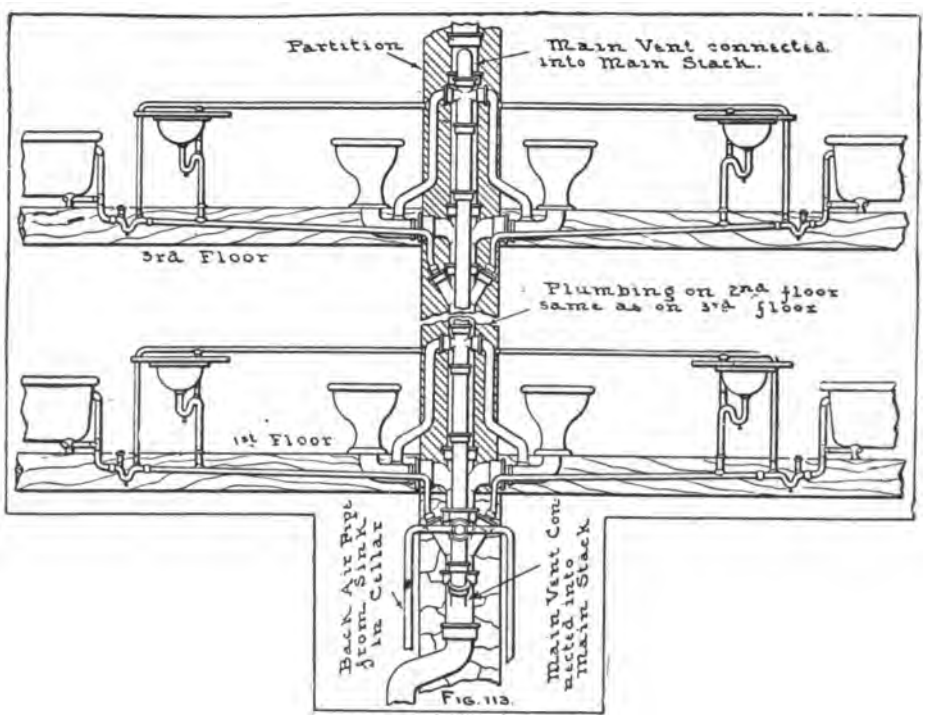
Partition
Main Vent connected into Main Stack.
3rd Floor
Plumbing on 2nd floor same as on 3rd floor
1st Floor
Back Air Pipe from Sink in Cellar
Main Vent Connected into Main Stack
Fig. 113.

ELEVATION OF BATH ROOM WORK.

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CHAPTER XXII

AS will be seen by reference to the floor plan of the six-flat department building shown in the last chapter, each flat is supplied with a refrigerator and each line of refrigerators on the two sides of the building is served by a line of waste or drip pipe. This pipe is usually of galvanized wrought iron, as stated by the note attached to Fig. 114, which shows the refrigerator work of the building under consideration. As the connection of each of the two refrigerators on the second and third floors into the main line of waste is the same as that on the first floor, we simply show the latter, with the drip sink and its connections below.

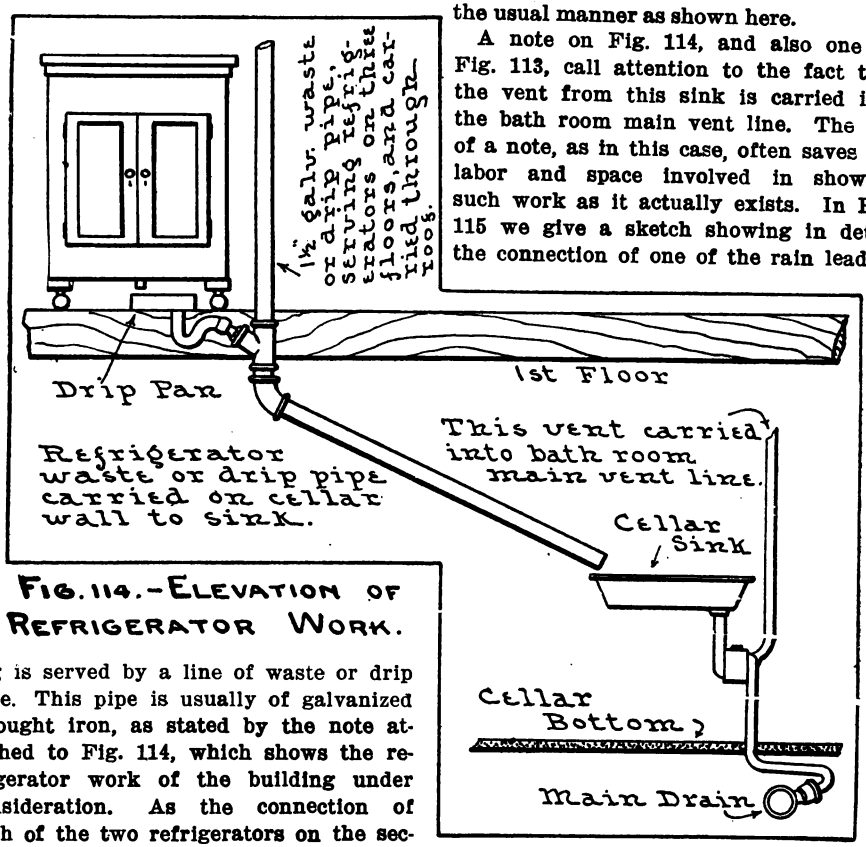
1½" galv. waste or drip pipe, serving refrigerators on three floors, and carried through roofs.
Drip Pan
1st Floor
Refrigerator waste or drip pipe carried on cellar wall to sink.
This vent carried into bath room main vent line.
Cellar Sink
Cellar Bottom
Main Drain

FIG. 114.—ELEVATION OF REFRIGERATOR WORK.

All modern ordinances prohibit direct connection of the refrigerator with the drainage system, and reference to our sketch will show that the line is disconnected at the sink, simply carrying the drip from the refrigerators into the sink, and the sink being trapped and vented in the usual manner as shown here.

A note on Fig. 114, and also one on Fig. 113, call attention to the fact that the vent from this sink is carried into the bath room main vent line. The use of a note, as in this case, often saves the labor and space involved in showing such work as it actually exists. In Fig. 115 we give a sketch showing in detail the connection of one of the rain leaders into the drainage system. It will be noticed that the leader is not provided with a trap. As a general thing, wherever there is a main trap no separate traps

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are placed on the rain leaders. If there were no main trap on this system, however, it would be necessary to trap separately each line of rain leaders.

Fig. 116 gives a sketch in detail of the cellar drainage. It represents a well formed in the concrete cellar bottom, with the hub end of a P trap cemented into the bottom of the well, and connected with the main drain. Into this well the various lines of sub-soil drain are carried. In some cities it is required by ordinance to carry the water supply direct to the cellar drainage well, so that in the event of a drought and the consequent evaporation of the trap seal, the seal may be renewed.

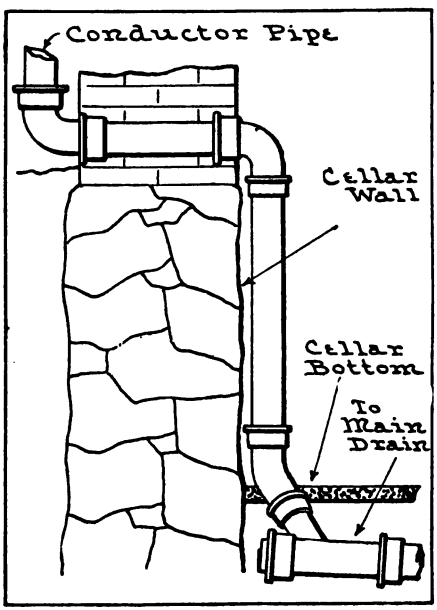

FIG. 115.—RAIN LEADER CONNECTIONS

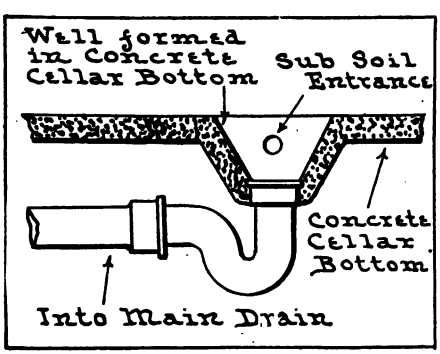

FIG. 116—CELLAR DRAINAGE CONNECTIONS.

With the main trap, however, this danger is not so much to be feared, for the main trap acts as a safeguard to the entrance of sewer gas through the cellar drainage system.

The sketch shown in Fig. 117 shows the work connected with the drainage system usually found at the front cellar wall. In order to economize space, instead of carrying the fresh air inlet up to a proper height, we have carried it low, and by cutting off the cellar wall, the fact that the full height is not shown is made known. The concrete is shown with a well formed about the cleanouts on the main trap, so that easy access may be had to them. Cast iron soil pipe is shown carried two lengths or ten feet outside the cellar wall, where it is entered into the tile drain.

This provision is made in most ordinances, to provide against the leaching back into the cellar of sewage that might escape from the tile drain if for any reason broken at some future time. The fresh air inlet is represented as carried underground twenty feet out into the lawn, and brought up to the surface, ending in a ventilating cap. The carrying of the inlet twenty feet away from windows and doors is a sanitary provision required by many ordinances.

Although not so difficult to execute as much of the preceding exercise work, it will do the reader no harm to practice on the work shown in these four sketches.

As we intimated in our last article, we have come to a point now where it is necessary to use an exact scale, both in laying out drawings and in taking dimensions from drawings.

It will no doubt already be known to most of our readers what the purpose of scale drawings is.

As an example, let us suppose that the civil engineer is getting out a map of property covering several acres. It is obvious that it is utterly impossible to make such a drawing full size. The drawing must, however, show everything in

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its proper proportion, and therefore, in order to get his work on a sheet of suitable size, he selects some scale. For instance, he may make his drawing on a scale of 1-16 inch to 1 foot, and if so, each 1-16 inch on the drawing represents a foot on the property which is being mapped out.

This is a reducing scale.

Now on the other hand, the draughtsman may be required to make drawings of some very small machine part, per-

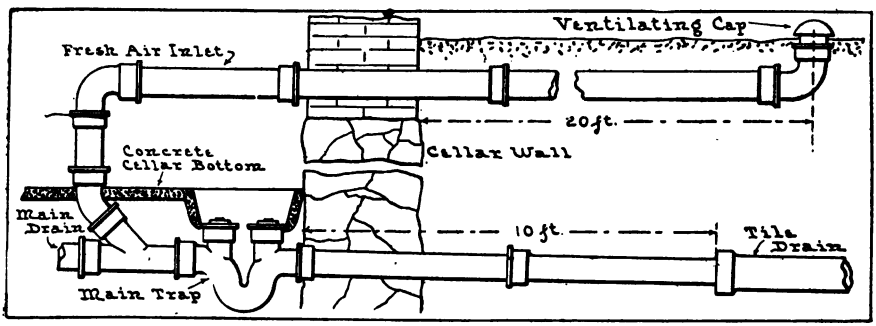

FIG. 117—MAIN TRAP AND FRESH AIR INLET CONNECTIONS, ETC.

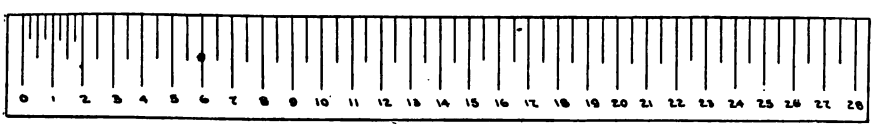

FIG. 118. Scale ¼" = 1 ft.

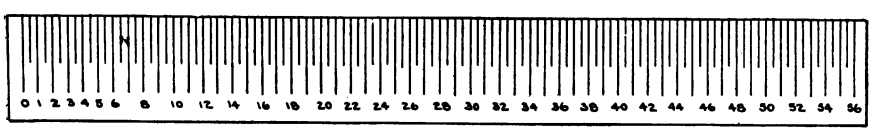

FIG. 119. Scale ⅛" = 1 ft.

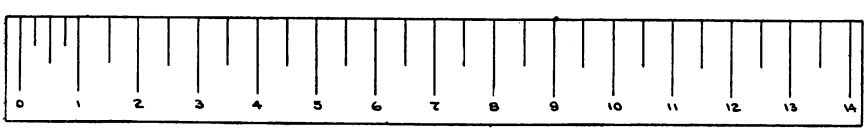

FIG. 120. Scale ½" = 1 ft.

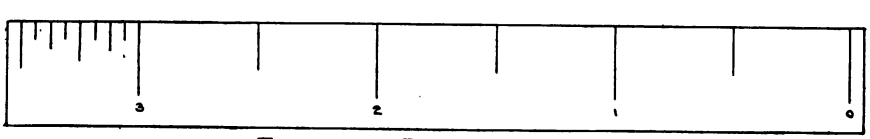

FIG. 121 Double Scale

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haps so small that when all the dimensions are placed upon it, it will be confused, and trouble the workman to work from it.

In this case it is necessary to choose a scale which will enlarge the drawing. A scale of 2 inches equal 1 inch is possibly used, and in this case, when the drawing is complete, a measurement on it of 2 inches represents 1 inch on the piece itself.

Now, in the work which we are following, we shall have use for both the reducing and increasing scales, but more especially for the former.

In Figs. 118, 119 and 120 we show three common reducing scales, and in Fig. 121 a common increasing scale.

The double scale (Fig. 121) or 1½ or triple scale, will be found of use in the practice work which we have been giving, in making an enlarged drawing from a smaller one. If there is a measurement of 1½ inch on the smaller drawing, and the double scale is being used, to represent that dimension on the enlarged drawing, three inches of the double scale must be taken, that is, from 0 to 3 on Fig. 121.

The small divisions at the left of this scale represent fractions of an inch, each of the smallest divisions representing 1-16 inch, the next larger ⅛ inch, the next ¼ inch, and finally ½ inch.

Fig. 120 shows a scale of ½ inch equals 1 foot, and is a scale that is sometimes used, though not so often as the ¼ inch and ⅛ inch. The ½ inch scale will be found very handy in making a large drawing of small work, for instance, in making a good sized drawing of the plans and elevations of the plumbing for a small house. It must be understood that in Fig. 120, for instance, each figured division represents a full inch on a drawing which is drawn to a scale of ½ inch equal 1 foot. Therefore, the full length of the scale shown would represent 14 inches, on the scale drawing, though measuring actually only half that amount.

We have chosen to consider lastly the two scales which are most important in this work, that is, the ¼ and ⅛ inch scales shown in Figs. 118 and 119. In the next chapter these two scales will be considered fully, and examples of their application given.

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CHAPTER XXIII

THE two scales of most importance to the architect and, therefore, of most importance to the plumber are those of ¼-inch = 1 foot, and ⅛ inch = 1 foot.

Of these, by far the more commonly used is the scale of ¼ inch = 1 foot, which is used for practically all ordinary work, the ⅛ inch scale being used on large work.

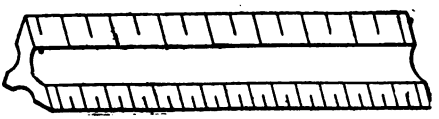

Fig. 124.

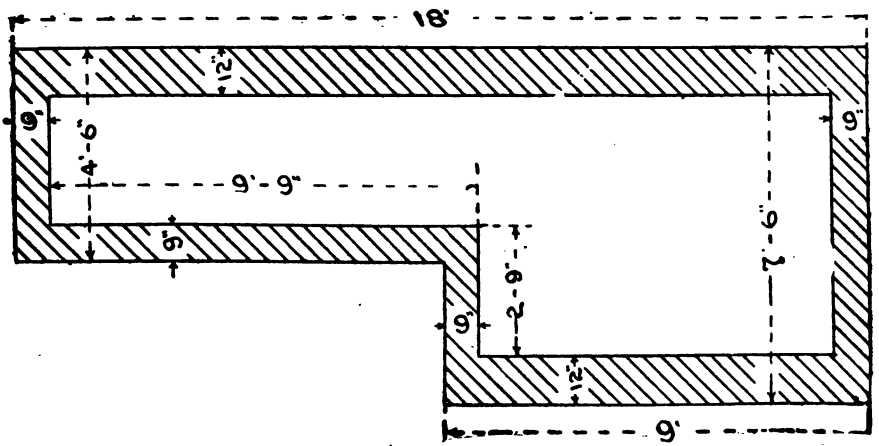

Fig. 122.

These two scales were shown in Figs. 118 and 119 of the preceding article.

In Fig. 118 each quarter-inch division represents 1 foot, and the total length shown represents 28 feet. In Fig. 119 each eighth-inch division represents 1 foot, and the total length shown represents 56 feet. Thus, in comparing the two scales, we find, as might be expected, that when equal lengths are laid off on each scale, that the given length represents on the ⅛ scale, just twice the dimension on the ¼ scale. In order to show in a practical way the application

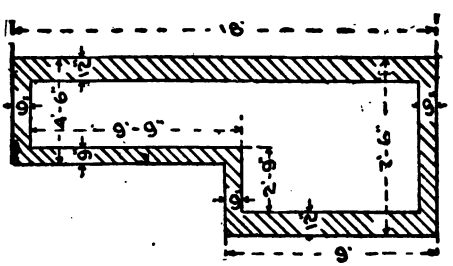

Fig. 123.

Fig. 125.

of the two scales, we give Figs. 122 and 123.

The former shows the work drawn on a scale of ¼-inch = 1 foot, and the latter on a scale of ⅛-inch = 1 foot.

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It will be noticed that while in the latter case the dimensions are one-half the former, the area covered by the drawing is only one-quarter as great.

There is one fact which should be thoroughly understood, and that is, that on a scale drawing, the dimensions should always be shown in full. For instance, in Fig. 122, the actual length of the sketch is 4½ inches, but it would be entirely wrong to place that dimension on the drawing. The dimension that should appear is the dimension that the 4½ inches represents on the scale that is being used, that is, 18 feet.

This point may not have needed an explanation, but it is a fact that very often those not used to working a scale, are inclined to make this error.

Wherever a dimension calls for fractional parts of a foot, as occurs several times in Fig. 122, fractional parts of a foot on the scale should be used.

Those of our readers who are putting to use the information given in this book will probably find it almost necessary to procure a scale for the work that we are about taking up. There are two styles of boxwood scales commonly in use, which we represent in Figs. 124 and 125.

The triangular scale is the more expensive of the two, and has a larger num-

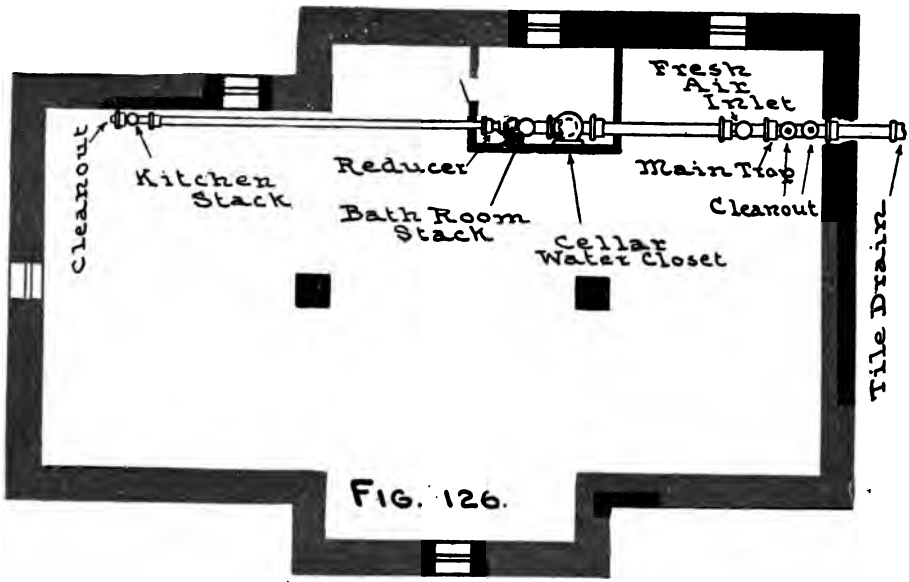

FIG. 126.

Cellar Plan for Cottage House. Scale 1-8 in.—1 ft.

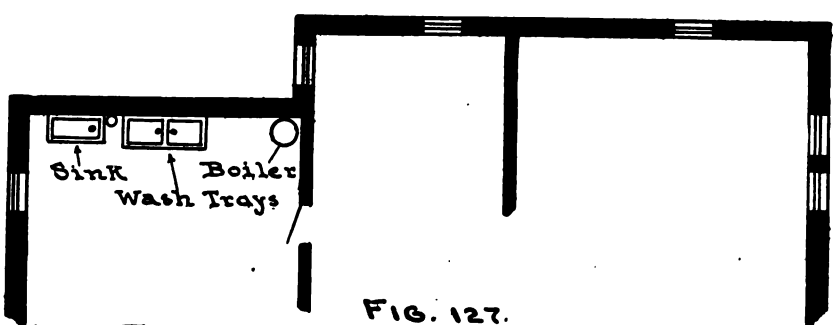

FIG. 127.

1ST. FLOOR PLAN — COTTAGE HOUSE
Scale ⅛ in. = 1 ft.

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FIG. 128

2ND. FLOOR PLAN - COTTAGE HOUSE
Scale ⅛ in. = 1 ft.

ber of different scales upon it than the flat scale. At the same time, if a flat architect's scale having a quarter and eighth scales can be procured, it will answer all purposes.

The flat scale has one great advantage over the triangular, from the fact that one often has to turn the latter several times before finding the scale desired, whereas the flat scale shows plainly at all times.

Now having looked into the subject of the different scales, let us apply it in the making of the several plans for a cottage house, this being the simplest construction that we can use for our purpose. Suppose we have a house to plan whose main dimensions are 36 feet x 24 feet. If we use a scale of ¼ inch = 1 foot, the plans will appear 9 inches x 6 inches, which calls for a larger space than we can afford to give up, although if we were laying out this work on a sheet of paper rather than on the page of a publication where every inch is of value, the quarter scale for work of this kind would be far preferable. Under the conditions we are obliged to show the plans and elevation of this work on a scale of ⅛ inch = 1 foot, and in much of the large work we should have to resort to a scale even smaller, probably 1-16 inch = 1 foot.

The cellar plan we show in Fig. 126, and such parts of the first and second floors as contain plumbing work are shown respectively in Figs. 127 and 128. In addition to the plans, we show in Fig. 129, a very simple elevation of the work in question. This elevation is of the most rudimentary style, but it gives us as much information in the line of plumbing as an elaborate and finished elevation; all we require is a knowledge of the distance between floors and the depth of floor timbers, and in addition the pitch of the roof in order to know the length of the vertical line of soil pipe. This elevation is obtained by viewing the house from the front, and it will be seen that in this view the two stacks would appear one behind the other. After drawing the cellar wall, to locate the position of the

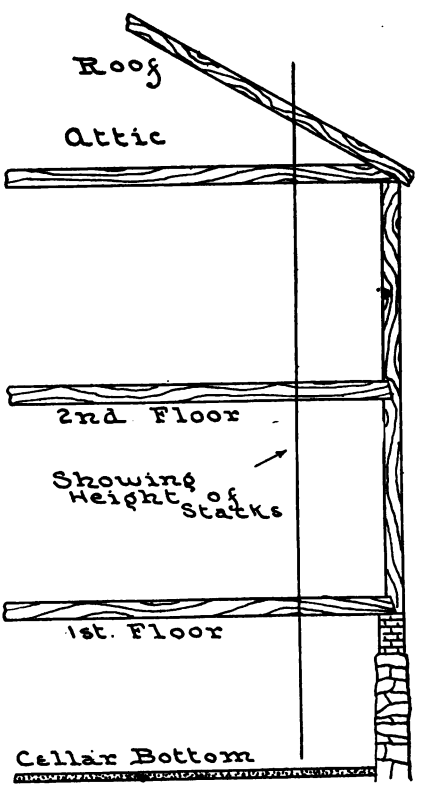

Fig. 129. Elevation for Cottage House.

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stacks in Fig. 129, measure to the left of the wall a distance equal to the distance on the cellar plan from the foundation to the center of the main drain.

We show simply a single line to designate the length of the soil pipe risers. If those of our readers who are not used to scaling drawings will figure out the distance in feet between the several floors and the depth of floor beams, it will be good practice for them, and this might be done also with the cellar plan.

In Fig. 130 we give two simple sketches of the two stacks shown on the cellar and floor plans. The same scale that has been used on these plans is used on the elevations of the two stacks, as far as heights between floors, etc., is concerned, but the diameter of the pipe, length of fittings, etc., is not drawn to this scale; in fact, not to any scale.

It can readily be seen that if this scale were followed on the piping the diameter of the 4-inch pipe would appear on our drawing as only 1-24-inch, which would be too small to show well. It will usually be found almost impossible to adhere to the scale on the piping for the reason just given.

We would advise the reader as excellent practice work, to work out the several floor plans on some scale larger than that which we have followed, completing fully the two floor plans which we have shown only partially complete, and also completing the work on the elevations of Fig. 130, by showing the fixtures and all their connections.

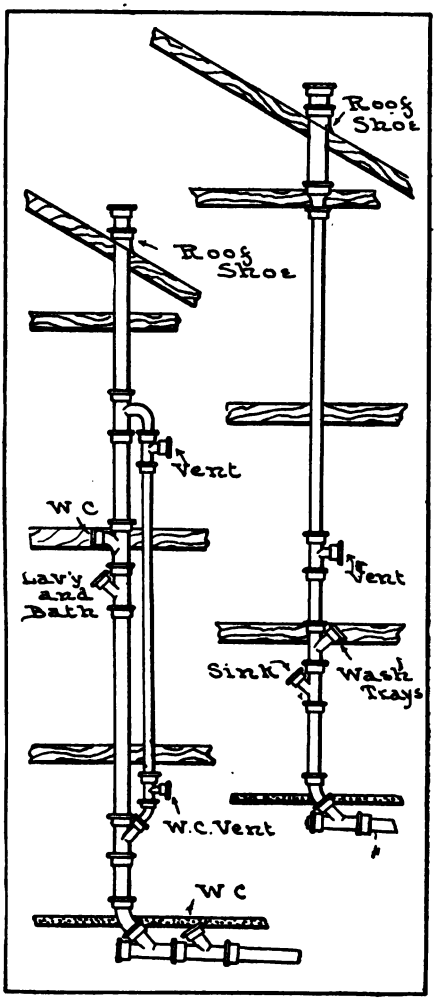

Fig. 130. Scale 1-8 in.—1 ft.

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CHAPTER XXIV

BEFORE leaving this part of our subject, there is one system, the plumbing for a country residence, which it is desirable to take up.

This work is different from city work in several respects, and we believe it will be of benefit to consider such a system.

For such a country residence we show

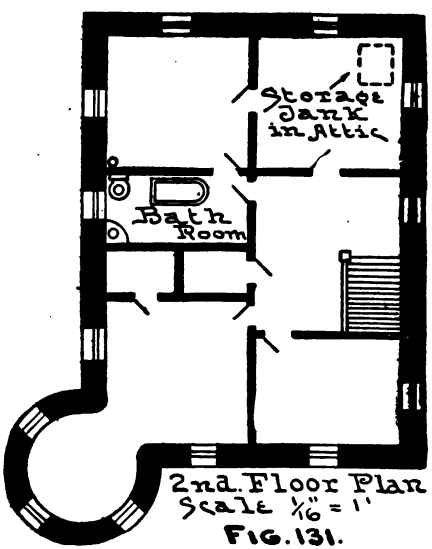

FIG. 131.

in Figs. 131, 132 and 133, the second and first floor plans and cellar plan respectively.

The cellar plan shows some difference from the same plan for city work, from the fact that on this plan, the locations of well, cesspool, etc., is shown. In the second floor plan, we show in dotted lines the storage tank to be located in the attic.

We have adopted this method in preference to going to the extra trouble of getting out a plan of the attic simply to show this one point.

On the cellar plan also, we have located the cesspool 50 feet from the house. Ac-

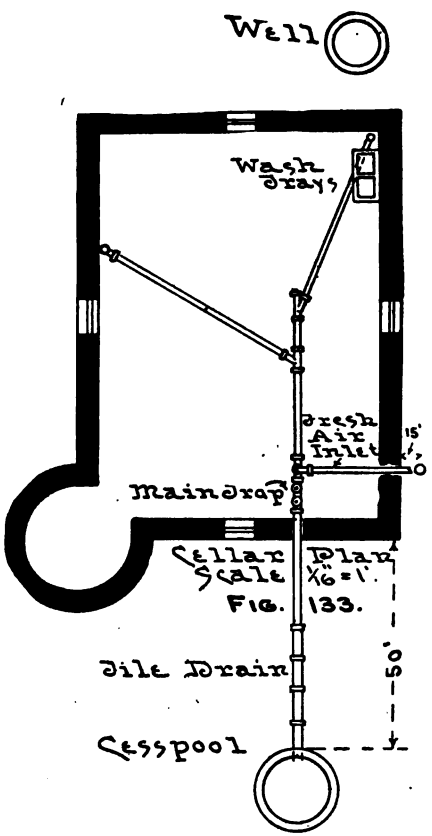

FIG. 133.

cording to the scale it will be found much closer than that, but where such a dimension is given it is always to be followed, and no attention paid to the distance that the regular scale would give. Fig. 134 gives a plain elevation of the residence,

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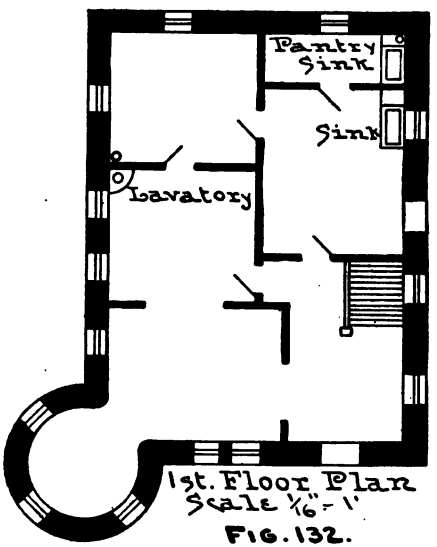
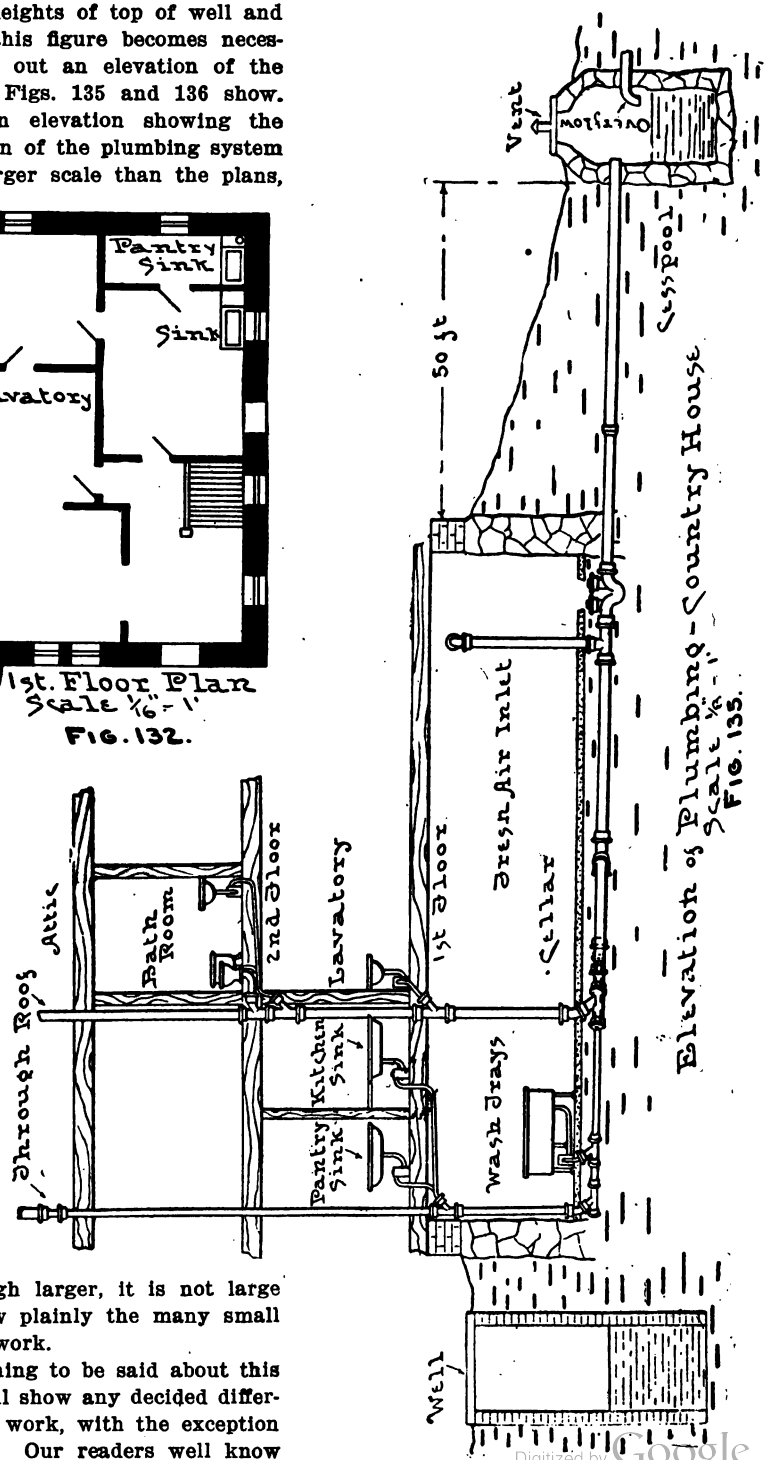
with relative heights of top of well and cesspool, and this figure becomes necessary in laying out an elevation of the work such as Figs. 135 and 136 show. Fig. 135 is an elevation showing the drainage portion of the plumbing system drawn to a larger scale than the plans,



1st. Floor Plan
Scale 1/8" = 1'
FIG. 132.



Elevation of Plumbing - Country House
Scale 1/8" = 1'
FIG. 135.

and even though larger, it is not large enough to show plainly the many small details of the work.

There is nothing to be said about this work which will show any decided difference from city work, with the exception of the venting. Our readers well know

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that as a general thing, work in the country is not done under the regulations of a plumbing ordinance, and for that reason in a majority of cases the work is put in without venting, though the country resident is gradually being convinced that he should have as good and as sanitary work in his house as his city brother.

Acknowledging that work of this kind has to be done, we show this plumbing system invented, and as a precaution against syphonage, show drum traps under the fixtures instead of the ordinary strap, which is more susceptible to syphonage.

On such work, the style of trap shown, or one of the modern anti-syphon traps, we believe far preferable to the S trap.

It will be noticed that in accordance with Fig. 134, our elevation shows the well located above the cesspool, which

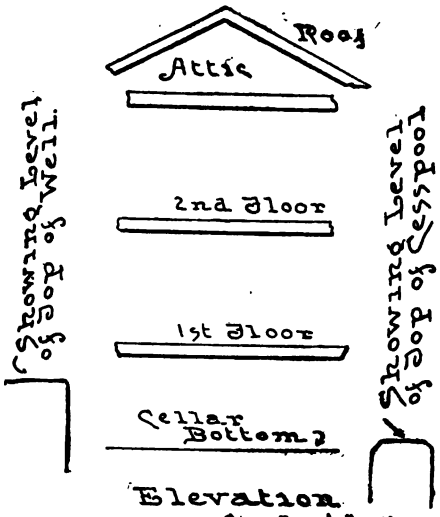

Fig. 131.

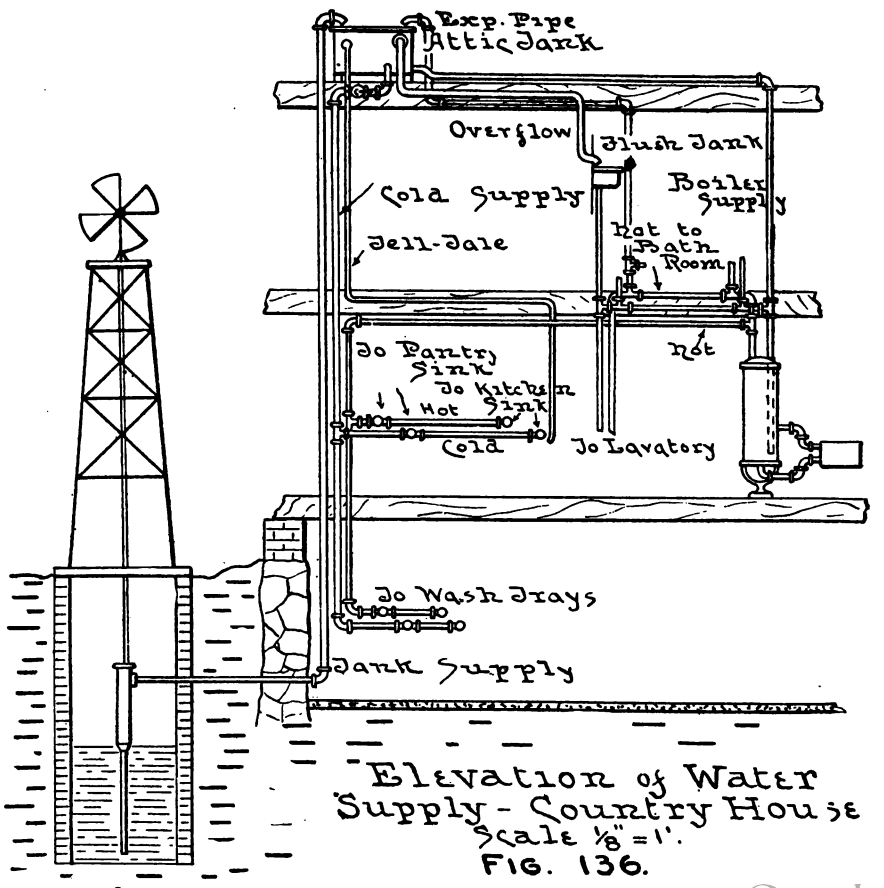

FIG. 136.

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should be demanded in order to lessen the danger of leeching of the contents of the cesspool into the well.

In Fig. 136 we give another elevation, showing the water supply for the house with windmill pumping to the storage tank.

This and the drainage system elevation are generally combined in one drawing, but on such a small scale greater clearness is obtained by keeping them separate.

Thus far in this series we have done more work in connection with the drainage end of plumbing than with the water supply, though both are equally important.

This needs attention before we bring our series to an end, and will therefore next claim our attention.

It will be a good plan for those interested, to work out the two elevations which appear in this article, using, however, a much larger scale, for the use of a small scale makes this work of such a puttering nature that it becomes very tiring, and furthermore, a larger scale would allow of showing small details, such as fittings, wiped joints, etc., and these little points go a long way to make an attractive drawing.

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CHAPTER XXV

CONCERNING the drawing of piping, there is nothing connected with it which differs at all in principal from the work which we have already been over. Consequently, the illustration which we present, will cover the greater part of the subject.

Figs. 137 and 138 show the water piping connected with range boiler work,

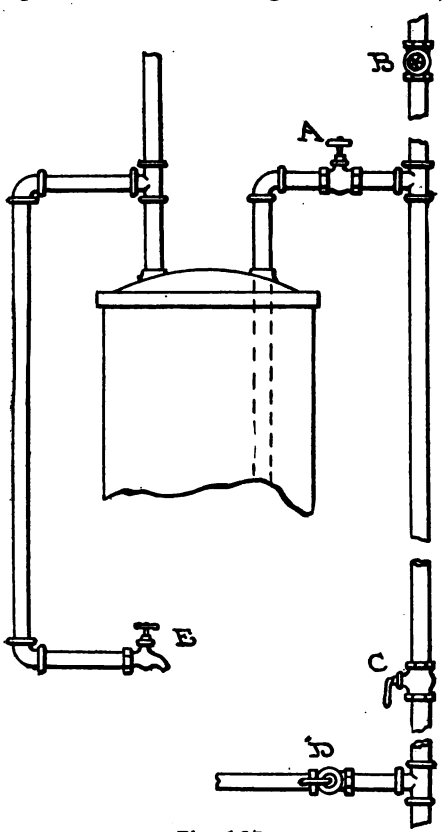

Fig. 137.

the former showing wrought iron pipe, and the latter lead. In each of these illustrations, A and B represent globe valves in two positions, A being seen from the side, and B from a position where the wheel appears in front of the valve. These same positions respecting the stop cock are shown at C and D. E shows a bibb.

A simpler and quicker way of showing this work, and one that is often just as desirable, is shown in Fig. 139, A, B, and C showing respectively a globe valve, stop cock and bibb.

If it is desired to make a distinction between the hot and cold pipes, it may be done by drawing one with solid lines, such as Fig. 139 shows, and the other by dotted lines. The same effect can be obtained very satisfactorily by showing the cold pipes with blue pencil or ink, and the hot with red. We might add, by the way, that this method is often followed in making the distinction between the drainage and the venting system of plumbing work.

Comparing Fig. 137 with Figs. 140 and 141, it will be seen in the former that the fittings are made of the same diameter as the pipe, while in the latter, which show larger sized pipes, the size of the fitting is made larger than the pipe.

The latter method is usually adopted in showing steam piping, while the former is used in water piping.

In Fig. 140, A, B, C and D show respectively the ell, reducing ell, tee, and reducing tee.

Fig. 141 shows 45-degree connections, with the main, from which the connection is taken, showing sidewise, while

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Fig. 142 shows a 45-degree connection with the main showing endwise. Furthermore, at the connection in Fig. 142, the fitting shown represents an ell which shows the pipe running back from the fitting, away from the observor. On the other hand, A in this same sketch shows the same fitting with the pipe pointing from the fitting toward the observer.

These matters, simple in themselves, are important in correctly representing this work, and are points that the aver-

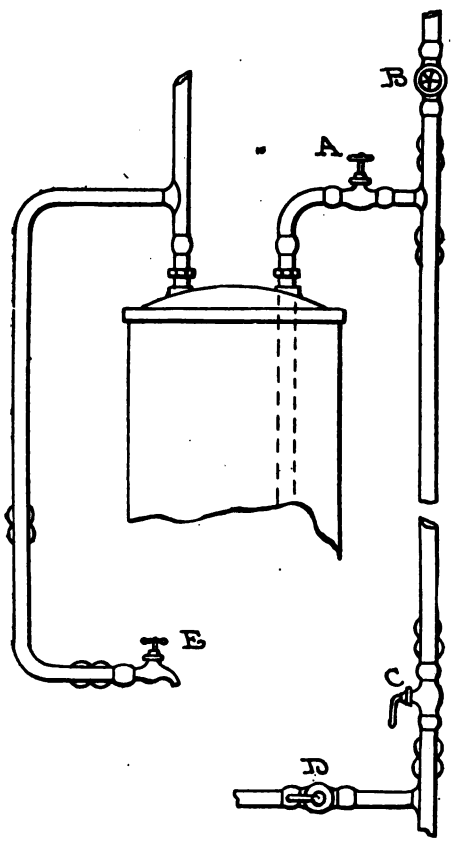

Fig. 138.

age man will get confused, with the result that the person who has to read the drawing either gets a wrong impression of what is desired, or is entirely unable to figure it out.

To the man who is unaccustomed to the making of drawings, among the most difficult things connected with this line of work, to represent properly, are the various styles of valves. To help him on such work as this, we give the sketches of Fig. 143. If he will compare the drawings of these different valves with illustrations of them in one of the trade catalogs, he will find that our sketches are made as simply as possible, such details for instance as the stuffing boxes, curves

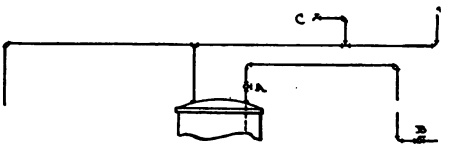

Fig. 139.

on the hexagonal parts of the valves, etc., being omitted. Of course these details add to the appearance of a sketch, but they take more or less time and skill, and the particular style of valve can be shown as well without them, and after all, that is the chief thing to be desired.

The several letters of Fig. 143 represent respectively: A, iron pipe cock; B,

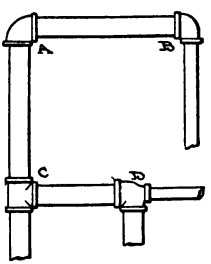

Fig. 140.

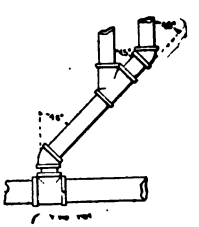

Fig. 141.

horizontal check valve; C, gas meter cock; D, globe valve; E, gate valve; F, cross valve; G, angle valve; H, Y-valve; L, radiator valve.

Another matter which usually presents difficulties to the man who is not acquainted with drafting, is the representing of radiators and coils.

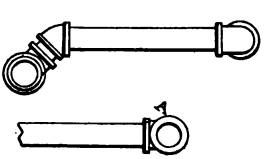

Fig. 142.

Figs. 144 and 145 show two methods of drawing radiators. The former naturally is the more difficult to work out, while the latter represents the radiator just as well.

In laying out this work, the space be-

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tween the sections should be about as our sketch shows it, that is, one-half the width of the section itself.

In putting in the semi-circles at the top and bottom of the radiator in Fig. 144 it is best to draw a line, such as shown by the dotted lines in the sketch, and

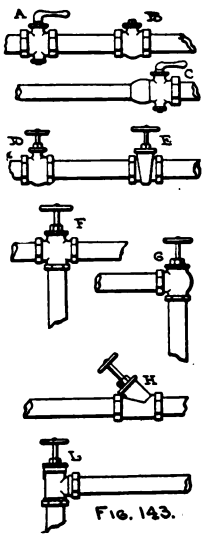

Fig. 143.

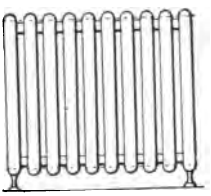

Fig. 144.

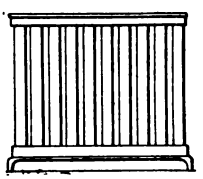

Fig. 145.

take the centers for the curves on this line, being sure of course to put in the curves before the straight lines are drawn.

The drawing of a coil of ordinary pattern, such as shown by Fig. 147, needs

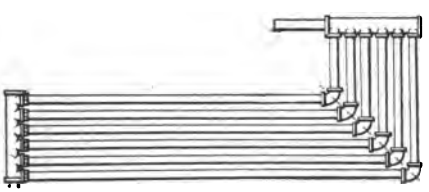

Fig. 146.

very little explanation, the drawing itself showing how the work should be laid out.

The drawing of a miter coil, such as shown by Fig. 146, needs some little attention, however. Lay out the horizontal and vertical pipes first and carry the lines until they meet each other. It will be found that the points of intersection

Fig. 147.

will be on an angle of 45 degrees, such as the dotted line shows in the sketch.

Having put in this line, which should be done in light pencil, the centers for striking the curves of the several ells may be taken on this line.

In taking up much of the work considered in this article, we are not adhering strictly to the requirements of the plumber, but as the work of the plumber and fitter are so closely allied, this work will prove of value to the average plumber we believe.

Our readers will find plenty of good practice work in the illustrations which we have presented in this chapter, and the drawing of valves, radiators and coils will be found of special value.

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CHAPTER XXVI

THE showing of steam pipes on floor plans is a matter that calls for attention, and in this connection we give Figs. 148 and 149. The method shown in Fig. 148 is the one which is probably most used, the pipes being represented by single lines, and the risers by circles.

The other method shown in Fig. 149 has the advantage of showing the connections of branches with the main, more in detail than the method just mentioned. A glance at the sketch will show that the tee on the main is turned at 45 degrees,

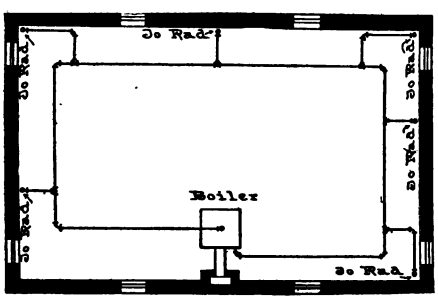

Fig. 148.

and a 45-degree ell brings the branch level again.

Now we come to the matter of showing piping in perspective, the last point which we shall take up in this series. It is of much importance, for it will be found that it is used a great deal, and furthermore, many systems of heating are very difficult to illustrate by any other means.

To get into this subject we show several simple examples of perspective in Fig. 150.

A represents a connection which inspection will show is viewed by looking down upon the object, and from the right, while B is obtained by looking downward from the left. Either of these two views is very common, much more so, we may say, than views obtained by looking upward upon the object. C shows a connection which is viewed from the left and on a level with it, instead of downward or upward, and occasionally is a desirable method to follow. D shows a little more difficult perspective than those preceding, and E shows valves in two different positions, in perspective.

A close study of these examples of perspective will show that the ellipses which are seen on the fittings are square with the direction of the pipe, no matter in what direction the pipe may run.

Compare F and G, which are supposed to represent the same thing. The ellipses in F are not square with the fitting or pipe, while those in G are. The result is apparent. The tee in F is distorted, while that in G is not.

If our reader will hold a piece of pipe in front of him with the end pointing toward him, that end will appear as a full circle, but if he will turn the pipe from this position gradually until it stands lengthwise instead of endwise, this circle will become an ellipse, gradually narrowing, until finally, when in a position lengthwise, no part of a circle or ellipse is to be seen, simply the square end being seen.

Perhaps this crude example will explain why, in this perspective work, the circles on the fittings appear as ellipses. In making a rule for this work we can perhaps do no better than to say that the straight lines of pipe should be first put in, in their proper directions, and the fittings connecting them put in afterward, and as previously stated, care be-

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ing taken that the ellipses are square with the piping.

To make an application of the work shown in Fig. 150, we give Fig. 151, which represents a heater with its piping. It

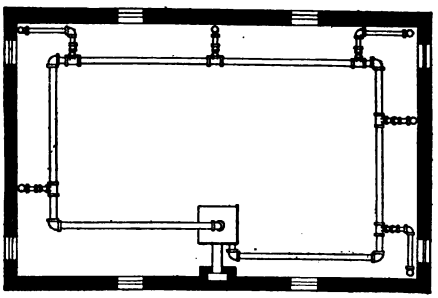

Fig. 149.

will at once be seen that the perspective of this work shows that it is obtained by viewing it looking downward and toward the left. The boiler was drawn first, with the lines V and W at 60 degrees with the horizontal front line of the boiler. In perspective, all vertical lines appear vertical, hence all the risers in Fig. 151 are vertical.

The line of pipe S-T is at right angles to the boiler and therefore must be parallel with the front line of the boiler, that is, horizontal. The lines A-B and K-L are of course parallel with the lines V and W of the boiler, and must therefore be drawn in that way, that is, at 60 degrees with the horizontal.

The lines of pipe shown at C, D, M and N are parallel with S-T and E-F, and are therefore drawn horizontally with the tee square.

The lines of pipe shown by G, H, P and R being on the work itself parallel to A-B and K-L are drawn parallel, that is, at 60 degrees with the horizontal.

In Fig. 151 we have lines of pipe running in four different directions in addition to the vertical lines, and we believe that this sketch will cover the ground

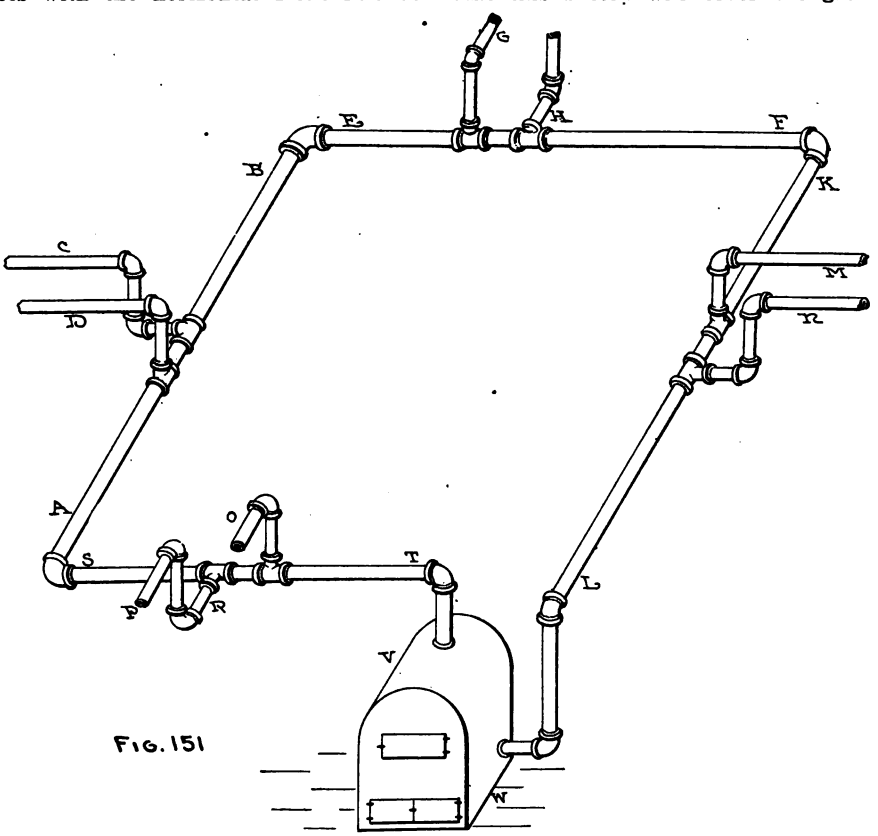

FIG. 151

Mechanical Drawing for Plumbers. Sketch Showing a Heater and its Piping.

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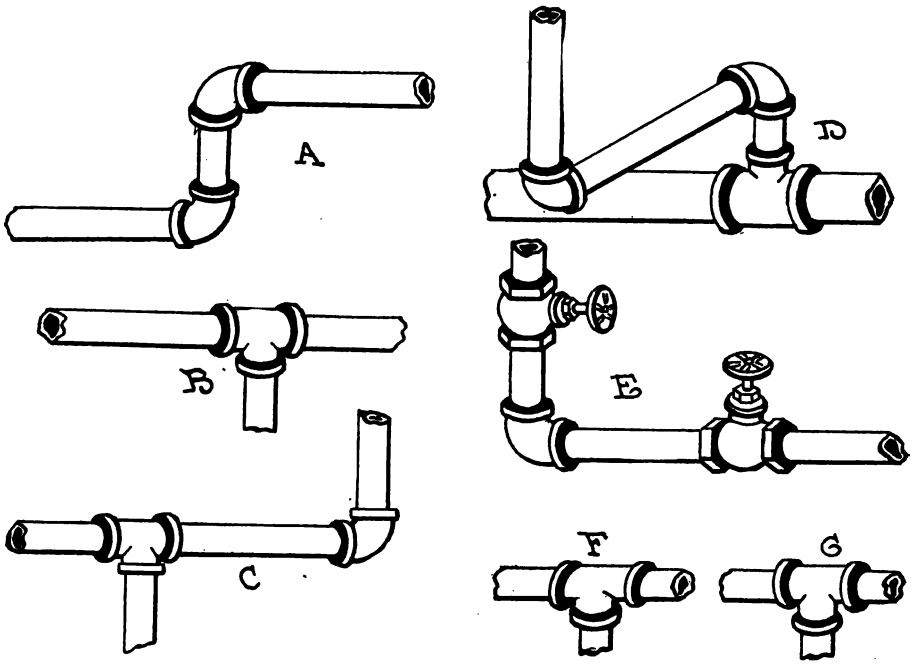

Fig. 150.

quite thoroughly, and therefore be of special value.

We might say that in perspective, the lines that run back, and away from the observer, appear to converge instead of appearing parallel, as they actually are.

This is illustrated by a straight line of railway tracks. We all know that if we look along a long stretch of track, the rails appear to converge, and if the distance is great enough, they seem finally to run together.

To be actually correct in showing the work of Fig. 151, the lines of pipe A-B and K-L, instead of being parallel, should be somewhat closer together from B to K than from A to L, but in mechanical perspective, as we may call the work that we are now considering, this principle is not usually given any consideration.

Very often on such work as shown in Fig. 151 the work as far as we have carried it, is shown in perspective, while the radiators, and all other work above the connections in the cellar, the work would show plain, just as we have hitherto shown it.

In bringing this book to a close with the present chapter we would say that we have endeavored to eliminate as far as possible all technical matters connected with the subject, trying as far as possible to express and explain the ideas to be conveyed in as straightforward and plain wording as possible, for it has been our aim to make the book equally as valuable to the apprentice boy as to the well informed master.

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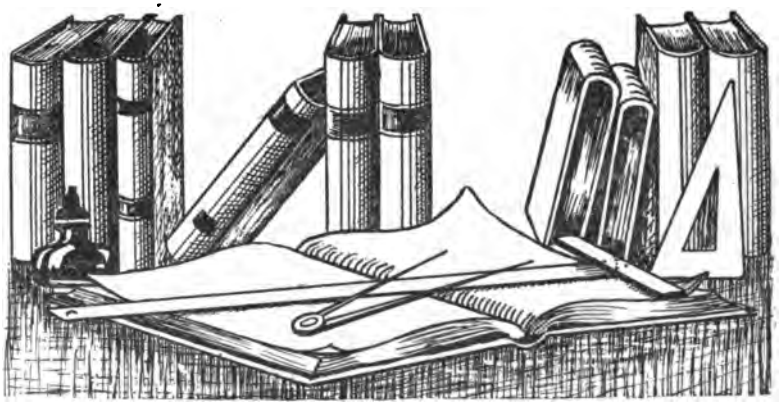

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